HP 9885M/S Flexible Disk Drive Service Manual
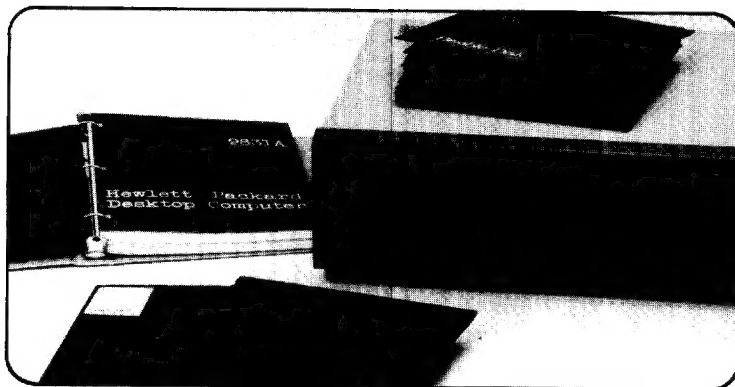
Manual Part No. 09885-90031

Microfiche No. 09885-99031

Printed Pages Only 09885-90032

NOTE

This manual replaces the original 9885 Service Manual (09885-90030) dated September 1976.

Printing History

New editions of this manual will incorporate all material updated since the previous edition. Update packages may be issued between editions and contain replacement and additional pages to be merged into the manual by the user. Each updated page will be indicated by a revised date at the bottom of the page. Note that pages which are rearranged due to changes on a previous are not considered revised.

The manual printing date and part number indicate its current edition. The printing date changes when a new edition is printed. (Minor corrections and updates which are incorporated at reprint do not cause the date to change.) The manual part number changes when extensive technical changes are incorporated.

<div align="center">

First Edition.......Sept. 1976   (P/N 09885-90030)
Second Edition.....October 1977   (P/N 09885-90031)

</div>

September 1978 Update Pages: ii, 6-11, 7-6, 7-10, 7-11, 7-13, 7-14, 7-15, Service Notes 5-3 and 5-4.

Contents

Chapter 5: Troubleshooting

Chapter 6: Circuit Diagrams

Chapter 7: Replaceable Parts

Figures

Tables

Chapter 1

General Information

Introduction

This manual provides installation and maintenance information for the 9885M or 9885S Flexible Disk Drive. Additional sections are provided at the back for keeping 9885 service and repair notes. This manual replaces the original manual, part number 09885-90030.

The information in this manual applies only to disk drive hardware operation. The disk format (structure) and file structure depend, to a great extent, on the computer software being used. The 9885M Installation Manual (see next section) covers the typical disk and file structure used by current HP desktop computers. For complete information on disk structure and disk drive commands, refer to the appropriate programming manual listed in the 9885M Installation Note. A copy of the current note is in the Installation section.

Description

The 9885M (master) drive contains control circuits for itself and up to three 9885S (slave) drives. Each drive is addressed individually via the controller and can hold one flexible disk at a time. Data is stored on one side of the disk. Each drive has its own internal power supply.

Product Support Packages

The 9885 Product Support Package (PSP) has the manuals, diagnostics, small parts and special tools needed to service 9885M/S Disk Drives. Two PSP's are available, one PSP supports drives connected to an HP 9800-series desktop computer; another PSP supports drives connected to an HP 21MX Computer. Copies of the PSP contents lists are in the Service Notes chapter.

Disk Drive Options

The following options are available for the 9885M and S.

Option 001 for 50 Hz Operation

This option is installed at the factory. It enables the drive to operate properly on a 50 Hz line frequency.

Option 002 Rack Mount Kit

This option allows you to mount your drive in a standard 19-inch rack mount cabinet. Although this option is usually installed at the factory, a rack mount field installation kit (98024F) is available.

The rack mount brackets are not able to support the entire weight of the 9885. A shelf or other support should be provided by the equipment rack or cabinet to support the weight.

Installation Procedure

1. Replace the standard side panels with those supplied in the rack mount kit (refer to the figure below).
2. Install the rack mount brackets with the screws provided in the kit.
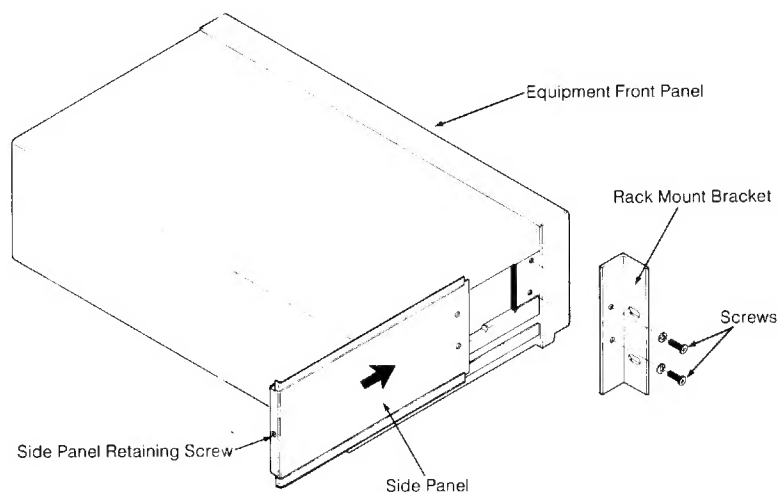
Rack Mount Installation

9885M Option 025

The option 025 drive is supplied with an interface, Disk ROM, programming manual, and other accessories to use the drive with the HP 9825A Calculator. See the 9885M Installation Note for the accessories supplied.

9885M Option 031

The option 031 drive is supplied with the accessories needed to use the drive with an HP 9831A Desktop Computer. The 9885M Installation Note lists the accessories supplied.

9885M Option 045

The option 045 drive is supplied with the accessories needed to use the drive with an HP 9845A Desktop Computer. Fundamental program and data storage operations are available with the standard 9845A. Advanced disk operations are provided with the Mass Storage ROM and described in its Mass Storage Techniques Manual. See the 9885M Installation Note for the accessories supplied.

Desktop Computer Interface

The HP 98032A option X85 Interface is used to connect the 9885M to an HP desktop computer. The first digit of the option number (e.g., 98032A opt 085) indicates which computer is to be used with the interface. In general, the interface and cable is the same for any option X85 — only the accessories vary. A wiring diagram of the option X85 cable is in the 9885M/S Installation Manual. [1]

The 9885M Installation Note lists where specific installation is described for a 9885 system; a typical installation is covered in the 9885M/S Installation Manual. For information on servicing the 98032A Interface, refer to its Installation & Service Manual (98032-90000).

HP 21MX Computer Interface

The HP 12735A Interface is used to connect the 9885M to an HP 21MX (E series or M series) computer. The interface and disk drive are supplied as the HP 12732A Flexible Disk Subsystem. Installation of the subsystem is covered in its Operating & Service Manual (12732-90005).

---

[1] The 98032A must contain a Rev. C   A1 circuit board to be compatible with the 9845A Desktop Computer. Also, A1C6 must have a value of 1000 pf.

Specifications

Capacity Per Disk

4,116,480 bits
514,560 bytes
2010 records (1 record = 256 bytes)
30 records per track
67 tracks

Rotation Speed

360 RPM

Disk Times

Head Load	40 ms
Step	8 ms/step + 8 ms settling
Latency	166.7 ms max − 83.3 ms average
Random Access	703 ms max − 267 ms average
Sequential Access	166.7 ms max − 83.3 ms average
Average Access Time	267 ms
Transfer Time	11.1 ms per record
Transfer Rate	23000 bytes/second

Command Times

The time to execute a read or write command is dependent upon the disk access time, since the time to set up the transfer is small ($<200\mu s$).

Initialization	5 minutes
Random Read/Write (1 record)	709 ms max − 273 ms average
Sequential Read/Write (N records)	703 + 11.1N ms max − 267 + 11.1N ms average

Line Frequency − 60 or 50 Hz ±3.5%

Power Consumption (max):

	9885M	9885S
100V	2.0A	1.8A
120V	1.6A	1.5A
220V	890 mA	820 mA
240V	800 mA	730 mA
	160 W	140 W

Dimensions:

Height:	133,3 mm (5.25 in.)
Width:	425,4 mm (16.75 in.)
Depth:	425,4 mm (16.75 in.)

Weight:

Net:	14,75 kg (32.5 lb)
Shipping:	21,14 kg (46.6 lb)

Temperature/Humidity Operating Range
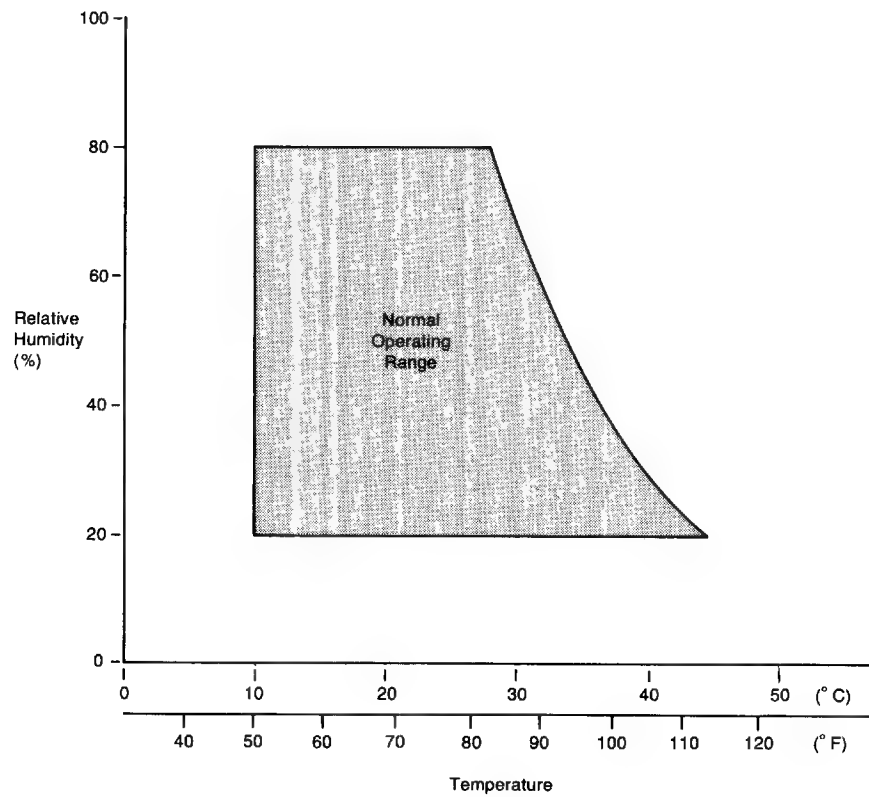
Chapter **2**

Installation

Typical System Installation

To install a 9885M or S in an HP desktop computer system, follow the procedure in the 9885M/S Installation Manual. A copy of that manual is in this chapter.

The accessories supplied with each disk drive are listed in Installation Notes which accompany each drive. Copies of these notes are included in this chapter.

HP 9885M Flexible Disk Drive

The 9885 Flexible Disk Drive is a random access, mass storage device capable of storing about ½ million bytes of data on a removeable plastic disk. The 9885M (master) drive connects to a computer and has built-in control for up to three additional 9885S (slave) drives.

Disk Drive Accessories

Before installing your disk drive, check to be sure you have the correct accessories —

Standard 9885M Accessories

Description	Quantity	Part Number
Installation Manual	1	09885-90010
Disk Care Note	1	09885-90020
Blank Disk	1	[1]
Power Cord	1	[2]
Spare Fuses (3 amp)	1	2110-0381
(2 amp for 220 V Drives)	1	2110-0303
Fuse Cap, European	1	2110-0544
Drive Number Labels (0 thru 3)	1 Set	7120-5839
Select Code Labels (8 thru 15)	1 Set	7120-5840
Disk Labels	1 Set	7120-6049
Write Protect Tabs	1 Sheet	7120-5388

[1] Blank disks may be ordered in packages of 5 using part number 09885-80004 and packages of 25 using part number 09885-80005.

[2] Power cords are shown in the 9885 Installation Manual.

Additional 9885M Option 025 Accessories

Description	Quantity	Part Number
Disk Programming Manual	1	09885-90000
HP 9825A Quick Reference Guide	2	09825-90011
Disk ROM	1	HP98217A
Initialized Disk	1	09885-90045
Disk System Cartridge	1	09885-90035
HP 98032A Interface	1	HP98032A Opt. 085
Notebook	1	9282-0580

Additional 9885M Option 031 Accessories

Description	Quantity	Part Number
Disk Op. & Prog. Manual	1	09885-90050
Flexible Disk ROM	1	HP98218A
Initialized Disk	1	09885-90060
HP98032A Interface	1	HP98032A Opt. 185
Notebook	1	9282-0580

Additional 9885M Option 045 Accessories

Description	Quantity	Part Number
HP98032A Interface	1	HP98032A Opt. 485
Notebook	1	9282-0580

Installation

Instructions on installing your disk drive depend on the computer being used. A typical installation procedure is shown in the 9885 Installation Manual. For instructions on connecting the 9885M to a HP 21MX computer, refer to the 12732A Subsystem Operating & Service Manual (12732-90005).

System Testing

The 9885M has a self test which checks each 9885 drive in the system. As explained in the installation manual, the self test can be run with or without a disk installed. IMPORTANT: The self test will erase data on track 0 of the disk; do not use an initialized disk with the self test!

To run a more complete test of the system, run the Checkread and Pattern Tests, as described in the appropriate manual furnished with your system —

Computer	Test Manual & Part No.
HP 9825A	Disk Programming (09885-90000)
HP 9831A	System Test Manual (09831-90031)
HP 21MX	12732A Diagnostic Manual (12732-90003)

System Operation

Operating and programming instructions for your disk system are in the appropriate manual −

Computer	Operating Manual & Part No.
HP 9825A	Disk Programming (09885-90000)
HP 9831A	Disk Operating & Programming (09885-90050)
HP 9845A	Mass Storage Techniques (09845-90070)
HP 21MX	12732A Programming Manual (12732-90001)

Service

The reliability of your disk system depends on the careful handling and storing of your disks. Follow the guidelines listed in the small Disk Care Note. In addition, each disk drive should be given an annual preventive maintenance (PM) inspection by an HP Customer Engineer. Contact your local HP sales aand service office for service information.

HP 9885S Flexible Disk Drive

The HP 9885S Disk Drive is to be connected to, and controlled by, an HP 9885M (master) Disk Drive. Installation and service information is covered in the 9885 Installation Manual supplied with the 9885M.

The items listed here are supplied with each 9885S.

Description	Quantity	Part Number
Disk Care Note	1	09885-90020
Blank Disk[1]	2	--
Power Cord (for U.S.A.)[2]	1	8120-1378
Spare Fuses: 3A (for 110-120 V)	1	2110-0381
2A (for 220-240 V)	1	2110-0303
Fuse Cap, European	1	2110-0544
Drive Number Decals (0 thru 3)	1 set	7120-5839
Select Code Decals (8 thru 15)	1 set	7120-5840
Disk Labels	1 set	7120-6049
Write Tabs	1 set	7120-5388
Interface Cable	1	09885-61607

[1] Blank disks may be ordered in packages of five using part number 09885-80004, and 25 using part number 09885-90005.

[2] Other power cords are shown in the 9885 Installation Manual.

Operating and Programming instructions are covered in the programming manual supplied with the 9885M.

Chapter **3**

Theory of Operation

Introduction

This chapter contains the 9885 theory of operation and block diagrams. The 9885 can be broken down into drive and controller sections. The mechanical drive with the drive electronics assembly (A5) is described first. The controller presentation includes the remaining circuit assemblies (A1 thru A4).

Drive Theory of Operation

The drive portion of the 9885M or S consists of the drive electronics assembly (A5) attached to the bottom of the drive, the drive mechanism, the read/write head, the head positioning mechanism and the removable disk. These components perform the following functions:

- Interpret disk commands

- Generate disk status signals

- Move the read/write head to the selected track

- Read and write data

Refer to the Drive Block Diagram and the A5 Circuit Diagram during the following presentation.

Drive Electronics Assembly (A5)

The drive electronics assembly interfaces the controller to the mechanical drive. Here is a description of the major A5 assembly circuits and their functions.

Index Detector

The index detector transfers the index pulse from the drive to the controller. The index pulse is generated once each revolution of the disk (every 166.7 ms). Normally this signal is high and makes a transition to a low for 1.7 ms once each revolution.

CONTROLLER   A5 DRIVE ELECTRONICS   DRIVE

STEP ─────────────→ ┌──────────────┐ STEPPER Ø1   ┌──────────────┐
                    │   HEAD   │ STEPPER Ø2   │   STEPPER   │
                    │   POSITION   │ STEPPER Ø3   │   MOTOR   │
                    │   ACTUATOR   │   └──────────────┘
DIRECTION ────────→ │   DRIVER   │
                    └──────────────┘

TRACK 0 ←────────── ┌──────────────┐   ┌──────────────┐
                    │   DETECTOR   │←────────────│   TRACK 0   │
                    └──────────────┘   │   SENSOR   │
                                                  └──────────────┘

INDEX ←──────────── ┌──────────────┐   ┌──────────────┐
                    │   INDEX   │   │   INDEX   │
                    │   DETECTOR   │   └──────────────┘
                    └──────────────┘

HEAD DOWN ←──────── ┌──────────────┐   ┌──────────────┐
                    │   HEAD   │   │   HEAD   │
                    │   LOAD   │─────────────→│   LOAD   │
HEAD LOAD ────────→ │   DRIVER   │   │   ACTUATOR   │
                    └──────────────┘   └──────────────┘

WRITE PROTECT ←──── ┌──────────────┐   ┌──────────────┐
                    │   WRITE   │   │   WRITE   │
                    │   PROTECT   │←────────────│   PROTECT   │
                    └──────────────┘   │   DETECTOR   │
                                                  └──────────────┘

DRIVE READY ←────── ┌──────────────┐
                    │   DRIVE   │   ┌──────────────┐
                    │   READY   │←────────────│   DOOR   │
                    │   DETECTOR   │   │   CLOSED   │
                    └──────────────┘   └──────────────┘

UNIT ─────────────→ ┌──────────────┐
                    │   DRIVE   │
SELECT ───────────→ │   SELECT   │
                    └──────────────┘

                    ┌──────────────┐
                    │   ERASE   │
                    │   HEAD   │
                    │   CURRENT   │   ╭──────╮
                    │   SOURCE   │   │ R/W │
                    └──────────────┘   │ HEAD │
                                                        ╰──────╯
WRITE ENABLE ─────→ ┌──────────────┐
                    │   WRITE   │
                    │   CURRENT   │
                    │   SOURCE   │
WRITE DATA ───────→ │   READ   │
                    │   AMPLIFIER │
                    └──────────────┘

READ DATA ←──────── ┌──────────────┐
                    │ TRANSITION │
                    │   DETECTOR   │
                    └──────────────┘

Drive Block Diagram

Track 0 Detector

The track 0 detector senses the track 0 flag on the carriage. The signal from the track 0 detector is "anded" with the phase 1 signal of the stepper motor by U5A. This signal becomes the Track 0 signal.

Head Position Actuator Driver

Step and direction signals (STEP, DRCT) from the controller are decoded into drive signals which are applied to three transistor drivers (Q1 thru Q6). Each driver output is applied to the head position actuator (stepper motor) to move the head forward or back a specified number of tracks. The stepper motor rotates a lead screw clockwise or counterclockwise in 15° increments. A 15° rotation of the lead screw moves the read/write head one track position.

Head Load Actuator Driver

A head load signal (HDLD) from the controller enables the head load actuator driver (Q7). The driver energizes an actuator which positions the head load pad against the disk. A head down (HDDW) status signal is delayed for 35 ms to allow for head setting. If a second head load signal is not received within 300 ms, the head will unload.

Read/Write Amplifier and Transition Detector

The encoded write signal (WTRN) from the controller along with a write enable signal (WREN) is applied to a write current source. The output of the current source (U28) drives the read/write head, writing the data on a disk.

When data is read from a disk, a read amplifier (U24) amplifies the data. The output of the amplifier is shaped and sent through a transition detector (U16) to further form the data into a digital signal. The data is then sent to the controller for decoding (RTRN).

Erase Head Current Source

When data is written on a disk, the write enable signal from the controller also enables the erase head current source (U28). When writing, the erase head erases the outer edges of the track to ensure that the data being recorded will not exceed the .012 inch track width.

Write Protect

When a write protected disk is installed, the write protect signal (WPRO) is sent from the drive to the controller. The signal is low when the disk is protected. Write protect inhibits writing on the disk.

Drive Ready Detector

The ready detector (U1) monitors several drive conditions and sends a ready signal (DRDY) to the controller when all the conditions are met:

- A disk is installed.

- The door is closed.

- Two index holes have been sensed after the door is closed.

Drive Select and Drive Number

The drive number set on the rear panel is sent to the A5 assembly on the SEL lines. The processor assembly addresses the drive on the UNT lines. If the SEL and UNT codes compare, subsequent commands will be accepted by that drive.

When SEL and UNT compare, the following A5 circuits are enabled:

- Head load

- Head positioning

- Read/Write

Drive Status

Drive status signals are sent to the processor assembly by U2 and U6. The status signals are:

DRDY	Drive Ready
DOPN	Door Open
INDX	Index Pulse
TRK0	Track 0 Detected
WPRO	Write Protect
HDDW	Head Down
PWR	Power Applied

Drive Mechanism

A drive motor rotates the disk spindle at 360 rpm through a belt drive. 50 Hz or 60 Hz power is accommodated by changing the drive pulley and belt. A registration hub, centered on the face of the spindle, positions the disk in the drive. A clamp presses the disk to the registration hub when the door is closed.

Read/Write Head

The head is a single-element ceramic read/write head with straddle erase elements to provide erased areas between data tracks.

Controller Theory of Operation

The controller consists of three circuit assemblies: the processor and I/O assembly (A3), the bit/byte converter assembly (A2) and the data electronics assembly (A4). Refer to the circuit diagrams of these assemblies and the following 9885M Block Diagram while reading this section.

Processor and I/O (A3)

The A3 assembly is the main sequencer and regulator for all disk operations. Other circuits in the controller are capable of performing a sequence of operations from a single A3 processor command.

The A3 assembly interfaces the 9885M to the computer and contains these circuits:

- The system clocks

- Processor

- ROM

- I/O buffers

- Drive control latches

- Status buffers

- Self test

The A3 assembly's I/O interface between the controller and the computer interface consists of:

- A 16-bit bi-directional data bus (DIO0-DIO15)

- A two line handshake (PCTL and PFLG)

- A status line (PSTS)

- An initialization line (PRESET)

- An external interrupt line (EIR)

- An extended control line (CTL0)

Commands to the controller, status words from the controller, data to be written on the disk and data read from the disk are all transferred on the 16-bit data bus under control of the two handshake lines.

Data from the computer is input to the controller on the 16 DI/O lines. The input data is received by multiplexers (U18 and U23) where the 16-bit data word is gated onto the D lines as two 8-bit bytes.

Data is sent to the computer through latches U1,U2,U3, and U10. The controller outputs two successive 8-bit bytes to the D lines to provide a 16-bit word for the DI/O lines. The lower 8 bits of a 16-bit word are latched into U3 and U10. The upper 8 bits are latched into U1 and U2. The 16-bit word is then sent to the computer interface on the DI/O lines.

Data to be written on the disk is sent on the D lines to the bit/byte converter assembly (A2). The operation of the bit/byte converter is controlled via the DC5 and DC6 lines.

Status from the drive(s) is received through U11 and U17. The processor sends status information to the computer.

The heart of the controller is the 8-bit processor and associated 16K ROM. The processor operation is sequenced by the clock. The clock also sequences the fetching of instructions from the ROM. ROM addresses are sent from the processor to the ROM on the PA lines (PA0 thru PA10). Before the ROM can output instructions to the processor, a start memory pulse (STM) is needed. Information to or from the processor is set on the D lines and the DC lines. If data is to be sent to or from the processor on the D lines, the device select lines (DS0 thru DS3) determine which section of the A3 assembly has access to the D lines. The DS lines are decoded by U21 and U26. The output of these decoders enables the different sections of A3. Here is a list of the different A3 sections enabled by the DS lines:

- The data input multiplexer (U18,U23)

- The 16-bit data output latch (U1,U2,U3,U10)

- The drive status gates (U11,U17)

- The drive command latch (U25)

- The drive select latch (U24)

- The marginal test and self test flag latch (U17)

- The error indicator latch (U20)

- The reset self test latch (U20)

DRIVE

A3 PROCESSOR & I/O

A4 DATA ELECTRONICS

P/O A3 PROCESSOR & I/O

READ DATA   RTRN

R/W DRIVER

R/W ELEC-TRONICS

R/W HEAD

WREN

WRITE DATA   WTRN

R/W RECEIVER

TRACK 00 DETECTOR

WRITE CONTROL

DATA DECODER

CLK (500kHz)

CLK1

2mHz   CLOCK   2mHz

PHASE LOCKED LOOP

CLK

PVAL

SC6

DRIVE STATUS RECEIVERS

PWR
HDDW
DRDY
DOPN
WPRO
TKØ
INDX

DRIVE STATUS DRIVERS

DCØ-DC7

PROCESSOR

PAØ-10

STM ROM

RDAT

CLK1   DECD

SELECT CODE GENERATOR

DSØ-3

SCII

DC3
DC4
DC5
DC6

AMDT

ADDRESS MARK DETECTOR

WRITE PROTECT DETECTOR

INDEX DETECTOR

DPØ-DP8

BIT/BYTE CONVERTER

PVAL

WREN
HDLD
DRCT
STEP
UNT1
UNTØ

DRIVE CONTROL RECEIVERS

HEAD LOAD

HEAD LOAD DRIVER

HEAD LOAD SOLENOID

ENCD
AMGN
WDAT

DATA ENCODER

DRIVE CONTROL LATCH

SC7

SC11

TRI STATE GATES

SC4
SC5

A2 BIT/BYTE CONVERTER

CLK

DIRECTION
STEP

DØ-D8   D LINES   D LINES

UNIT NUMBER DECODE

DRSL

STEPPER DRIVE

STEPPER MOTOR

SC LINES   SC LINES

9885M Block Diagram

The basic system clock is an 8 MHz oscillator. This basic clock is changed to a two-phase 4 MHz clock by U5 and U6 to synchronize operation of the processor and ROM. In addition, 8 MHz, 1 MHz and 500 KHz clocks are provided for the other controller assemblies.

When the self test switch is activated on the rear panel, the STST line causes the controller to be initialized and then execute the self test routine.

The processor will execute an initialization routine when any of the following occur:

- Power is applied to the 9885M.

- Preset is sent from the interface.

- Self test switch is pressed.

Bit/Byte Converter (A2)

The bit/byte converter interfaces data between the processor assembly (A3) and the data electronics assembly (A4).

Data to be written on the disk is sent to the bit/byte converter assembly on the D lines. The data is latched into U24 and U25 and then into U17 and U18. After an 8-bit byte is in U17 and U18, a shift is initiated which shifts the byte out of U18 to the data encoder on A4. At the same time, the data byte is input to the checkword register (U7,U14,U21 and U28). At the end of each 256-byte record, the contents of the checkword register are shifted out (OCRC = low) to the encoder to be written at the end of the record. Thus, during a write operation, the A2 assembly converts 8-bit bytes from the A3 assembly into serial data for the data encoder on the A4 assembly.

Data read from the disk is first sent to the decoder on the A4 assembly, then it is input serially to U17 and U18. When an 8-bit byte is shifted into U17 and U18, it is transferred to U19 and U20, and gated (8-bit parallel) to the processor assembly through U26 and U27. Data being read is also sent to the checkword register. At the end of the record, the checkword that was previously written on the disk is shifted into the checkword register. If the two checkwords are the same, the checkword register contains all 1's and no errors have occured. If the checkwords do not compare, a checkword error (from U12) is sent to the A3 assembly. Thus, during a read operation, serial data from the decoder on the A4 assembly is converted to 8-bit bytes and set to the A3 assembly.

The operation of the A2 assembly is sequenced by a state register (U10 and U11). The address mark detect line (AMDT) and the DC5 and DC6 lines determine the states of U10 and U11. In addition to sequencing the A2 operation, the state register also sends encode or decode commands to the data electronics assembly (A4).

Data Electronics Assembly (A4)

The data electronics assembly can be divided into three sections; the encoder, the decoder and the phase-locked loop.

Encoder

The encoder combines the data to be written on the disk from the A2 assembly with clock pulses to form a series of bits (ones and zeros) which will be recorded on the disk. The recording technique used is "double density recording". Using double density it is possible to store twice as many bits in a given area on the disk without changing the transition density. This means that each data bit is written in the center of a bit cell (see below). Clock bits are written at the leading edge of a bit cell if no data or clock bit was written in the previous cell, and no data bit is to be written in the present cell. Here are some examples of double density recording:
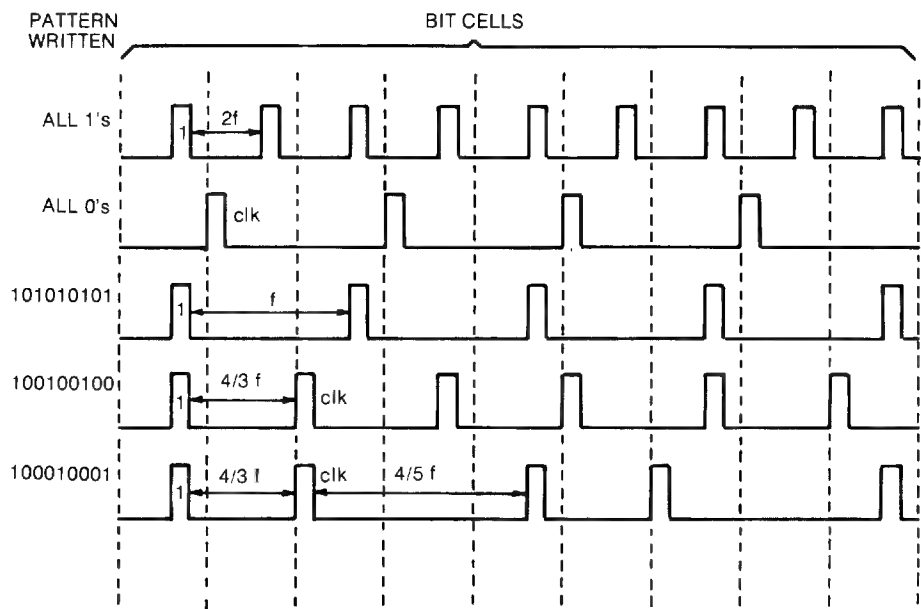
Double Density Recording Technique

This figure shows the format of each record on the disk:

PREAMBLE 4 bytes of 0's 4 bytes of 1's	ADDRESS MARK 1 byte	TRACK NUMBER 1 byte	SECTOR NUMBER 1 byte	CHECKWORD 2 bytes	POSTAMBLE 1 byte of 0's	16 bytes of 0's	PREAMBLE 4 bytes of 0's 4 bytes of 1's	ADDRESS MARK 1 byte	DATA 256 bytes	CHECKWORD 2 bytes	POSTAMBLE 1 byte of 0's	34 bytes of 0's

(Header spans PREAMBLE through POSTAMBLE of the first group)

Note: The header is written on the disk only during initialization

Record Format

The encoding operation is controlled by the state machine comprised of a programmed logic array (U26) and a 3-bit state register (U27 and U30). Encoding is enabled by an encode command signal (ENCD) which is sent from the A2 assembly.

U22 is a serial-in, parallel-out shift register. U16 is a 1 of 7 decoder. U16,U22 and U27 form a network to provide precompensation for pulse crowding.

Decoder

The decoder translates the transition patterns read from the disk into a sequence of bits. The bits are then sent to the bit/byte converter (A2). A decode command (DECD) from the A2 assembly starts the decoding process. The inputs to the decoder are the read transitions (RTRN), the 500 KHz clock and the phase-locked loop clock. U19, U23 and U24 control the decoding process.

U8 and U9 are a data/clock separator. U3 and U17 act as a detector which senses an address mark (a unique bit pattern) and outputs an address mark detected signal (AMDT) when the address mark occurs.

Read data (RDAT) is the actual series of bits that is sent to the bit/byte assembly.

U10,U11,U12 and U19 form a marginal transition detector. If a data transition is not properly positioned, it is considered marginal and is indicated by setting MTST high.
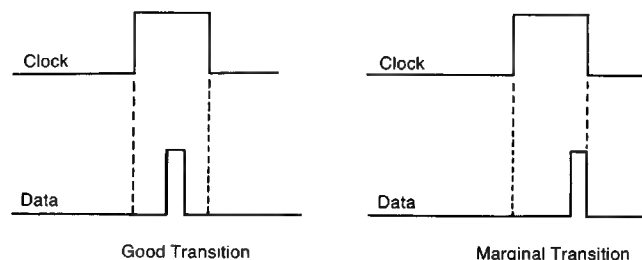
Transition Detection

Phase-locked Loop

The purpose of the phase-locked loop (PLL) is to generate clock pulses that are synchronized in phase and frequency with the transitions read from the disk. The PLL clock (U15 and U14) is actually a variable frequency oscillator and is used by the decoder to separate the data and clock pulses. The clamp signal is used to synchronize the PLL clock in phase with pulses read from the disk prior to the "locking up" of the PLL.

A filter comprised of C33,C37 and R43 controls the response time of the PLL to changes in the Sample signal. It is desirable to read the preamble of a record with a very quick response time to enable the PLL to lock easily. When reading the address or data, it is better to dampen the response time to reduce sensitivity to noise and transient pulses; the Fast Lock signal controls this. Fast Lock is true when reading the preamble and false at other times.

U21 is a detector which compares the PLL clock and the Sample signal from the decoder (see below).

The detector generates an error signal which is used by the PLL to compensate for frequency variations in pulses read from the disk. If the Sample pulse occurs as the PLL clock crosses zero, there is no error. Error magnitude varies with the time between the PLL clock zero crossing and the center of the sample pulse.

No Error   Error
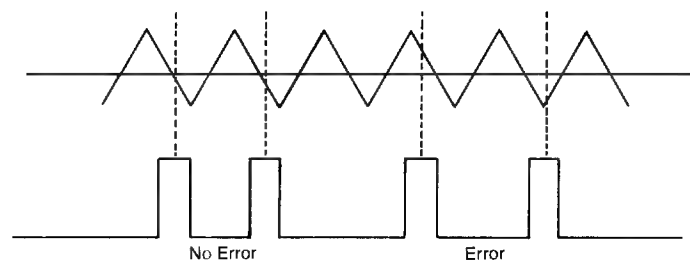
Detector Signal Comparison

Power Supply (A1)

Refer to the power supply circuit diagram. The power supply assembly provides ±5 V, +12 V, and +24 dc to the 9885 circuits. ±5 V and +12 V are used to power the logic circuits. +24 V is used to power the head position stepper motor and the head load solenoid. ac from the transformer secondary winding is used to power the drive motor which turns the disk.

Chapter 4

Maintenance

Introduction

This chapter covers the 9885 assembly access information and the 9885 mechanical and electrical adjustments. A recommended preventive maintenance schedule is given below.

Preventive Maintenance

A good preventive maintenance schedule will result in greater system reliability. Visual inspection of the drive should be the first step in every scheduled maintenance operation. Always look for corrosion, dirt, wear, binding and loose connections. Cleanliness cannot be overemphasized in maintaining the disk drive. Do not lubricate the drive. Oil will allow dust and dirt to accumulate.

Annual PM Schedule

Item	Observe	Action
Read/Write Head	Oxide build up	Clean Read/Write head ONLY IF NECESSARY
	Check for proper alignment	Perform head alignment if necessary
R/W Head Load Button	Excessive wear	Replace
Stepper motor and lead screw	Inspect for nicks or burrs	Clean off all oil, dust and dirt
Belt	Frayed or weakened areas	Replace if necessary
Chassis	Inspect for loose screws, connectors and switches	Clean chassis
Read Amplifier Balance	Correct Waveform	Adjust

Tools Required

The tools required to disassemble and assemble the 9885 are —

- Flatblade screwdriver
- Pozidrive screwdriver
- Right Angle Pozidrive screwdriver
- 1/4" wrench
- 11/32" wrench
- Set of allen wrenches
- Needlenose pliers
- Pin extractor or paper clip

Extracting Pins

Some of the assembly access procedures require that pins be extracted from the A5 P5 connector. To extract pins from this connector, insert the end of a paper clip between the pin and the connector wall from the front of the connector (see below). Pull the wire and pin from the back of the connector. When connecting P5, the numbered pins should face the component side of A5.

Wire from back
of connector

Connector Pin

Wire from Back
of Connector

End View of Connector

Paper Clip or
Pin Extractor
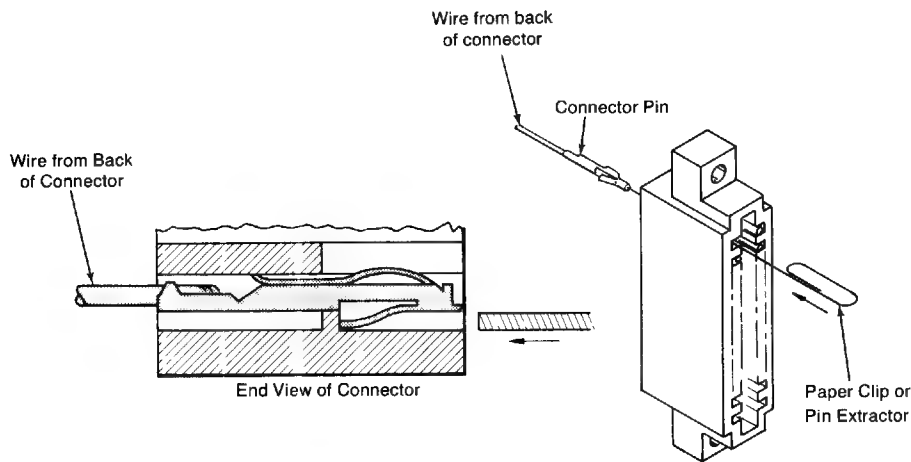
Extracting Pins from P5

Assembly Access

All the 9885 assemblies can be accessed by removing either the top or bottom cover. The assemblies found under each cover are shown next. Under the top cover is a plastic dust cover over the drive that must be removed to access the upper drive assemblies. This dust cover simply lifts off the drive.

To remove either the top or bottom cover, loosen the screw at the back center of the cover, slide the cover back and remove it. In a like manner, the side covers can be removed.

NOTE

When installing the covers, ensure that the front edge of
the cover fits in the slot in the front panel.

A

Front Panel

A3 Processor & I.O
09885-66503

A1 Removal Screw

A1 Power Supply
(with heat sink)
09885-66501

Drive Dust Cover

A1 Removal Screws

Stepper Motor

A2 Bit/Byte Converter
09885-66502

A4 Data Electronics
09885-66504

Shield for Transformer

Drive Motor
Assembly

B

Connector P5

A5 Drive Electronics
09885-66505

Front Panel

A0 Motherboard
09885-66500

Left
Side

Right
Side

A5
Removal
Screws

Drive Cable   Motherboard Cable   Power Switch
Cable

Transformer
Connector

9885 Top & Bottom Assemblies

Disk Guide   Front Panel   Index LED

Hub Clamp Plate

Disk Eject
Assembly

Lead Screw

Head Load Actuator

Track 0
Detector

Write Protect
Detector

Carriage Assembly

Drive Motor

Stepper Motor

Drive Motor
Capacitor

Drive Top

Door Closed
Switch   Index Detector   Front Panel

Drive
Connector

Spindle
Pulley

Drive
Belt

Stepper
Motor

Drive Motor Pulley
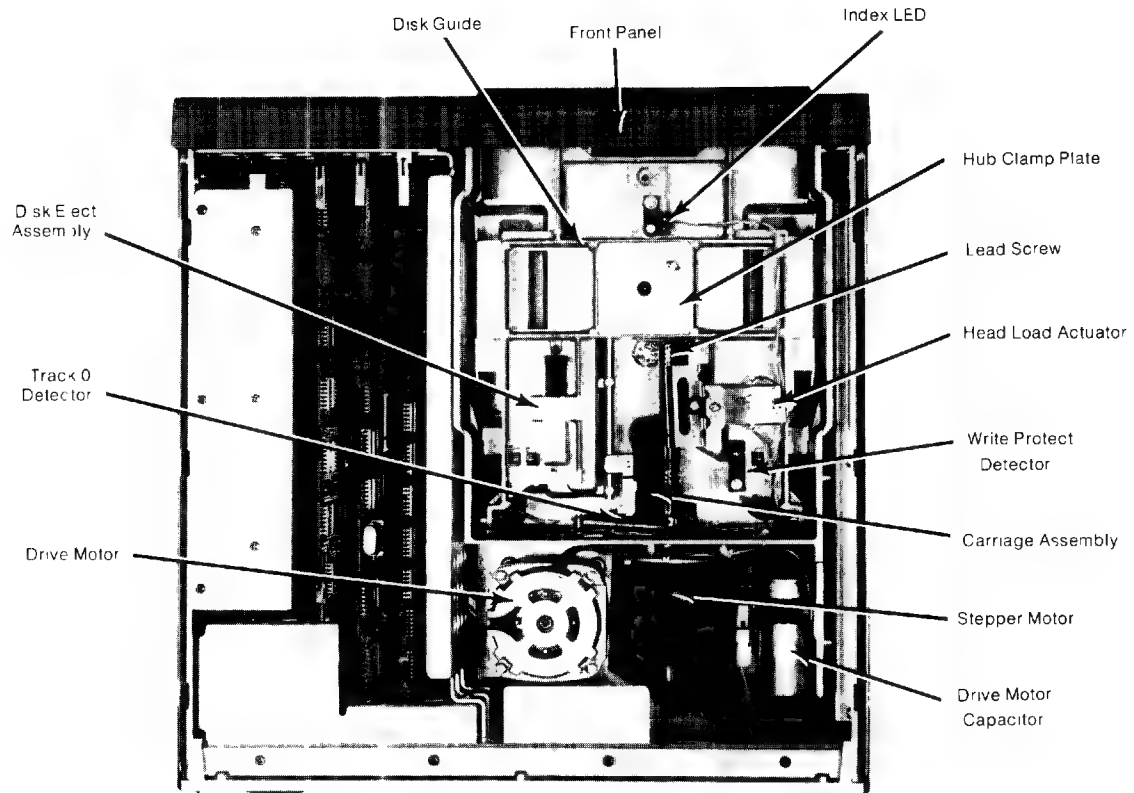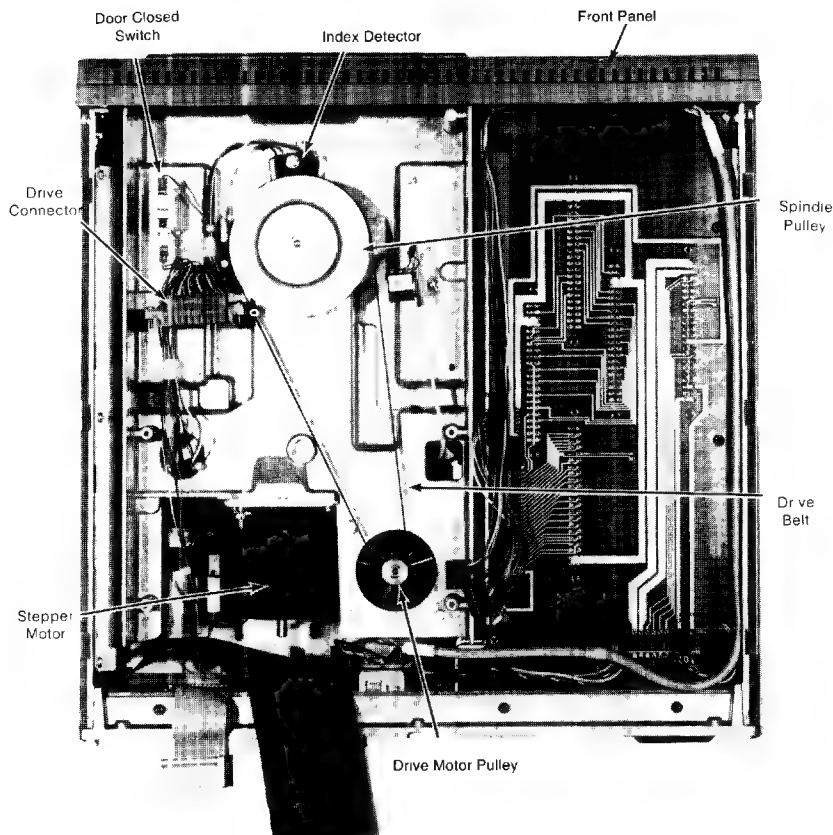
Drive Bottom

CAUTION

REMOVE ALL AC POWER BEFORE REMOVING ANY 9885
ASSEMBLY.

Assembly Removal

The following procedures will help you disassemble the 9885. Unless otherwise noted, the assemblies are assembled by reversing the given procedure. When moving or replacing assemblies, always perform any necessary adjustments.

Controller Removal

A1 — Remove the three screws holding the heat sink to the side casting. Pull the assembly up and out of the 9885.

A2,A3 and A4 — Press outwards on the colored extractors; then lift the assembly up and out of the 9885.

Rear Panel Removal

Remove the top, bottom and side covers. Remove A1 through A4. Remove the six screws in figure A on the right side panel and remove the four screws in figure B on the left side panel holding the rear panel to the side frames. Then remove the three screws shown in figure C and remove the panel. Pull the back panel to the rear and off the chassis. Disconnect the various cables connecting the rear panel to the 9885. The rear panel assemblies are shown in figure D. When replacing the rear panel, be careful not to pinch any wires.
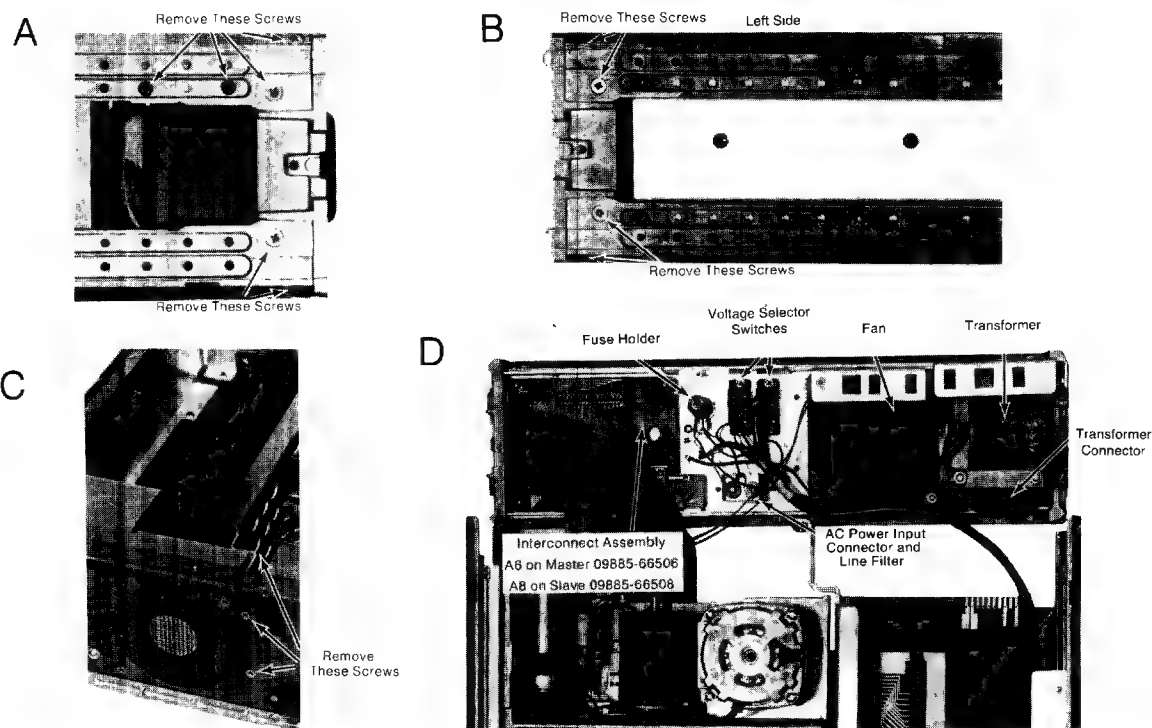
Rear Panel Removal

Drive and Front Panel Removal

1. Remove A1 through A4.
2. Remove the drive motor cable.
3. Remove the two screws on each side of the 9885 that hold the front panel to the side frames (see figure A below).
4. Remove three screws holding the drive casting to the left side frame.
5. Remove two screws holding the drive casting to the center bracket (figure B).
6. Remove three screws holding the center bracket to the front panel.
7. Remove the front two screws on the A0 motherboard (figure C).
8. Remove the drive/front panel assembly and disconnect the various cables that connect to it.
9. Remove the left front bracket (figure D).
10. Remove four screws holding the drive to the front panel.
11. Loosen the two screws holding the door to the disk guide and remove the front panel from the drive.
12. Remove the cable from the A7 indicator assembly.

A

Remove These Screws

B

Remove These Screws

Remove These Screws

C

Remove
These Screws

D

Front Panel Screws

Front Panel Screws

Door Screws

A7 Indicator Assembly
09885-66507
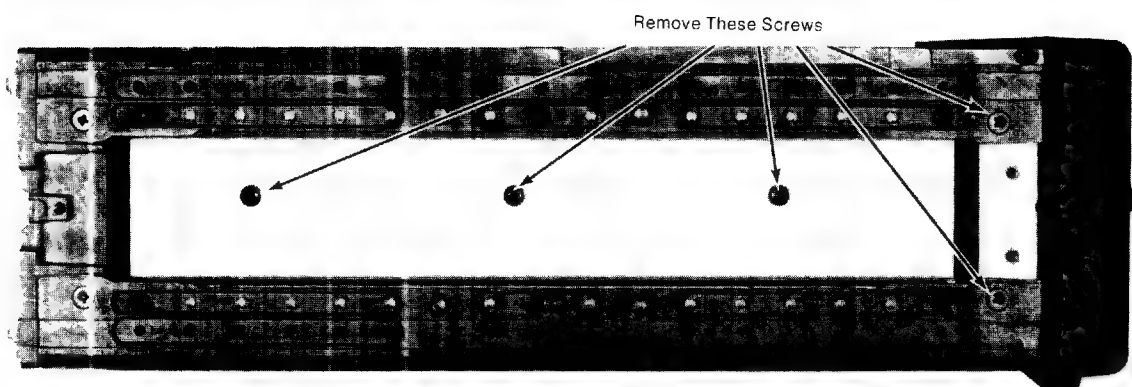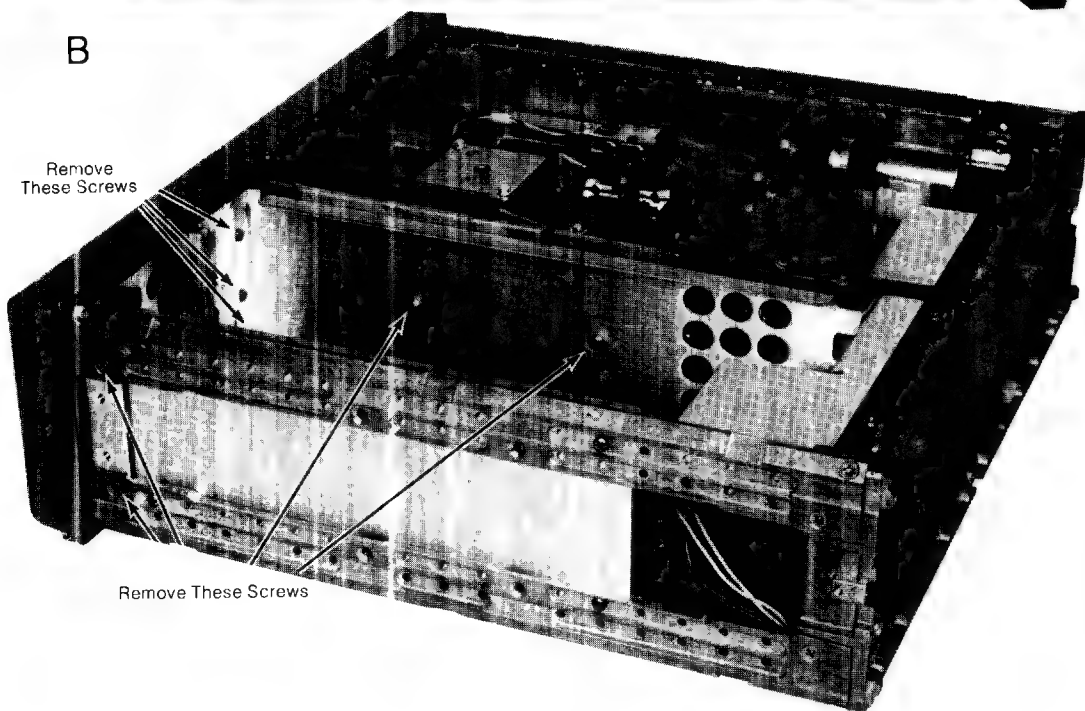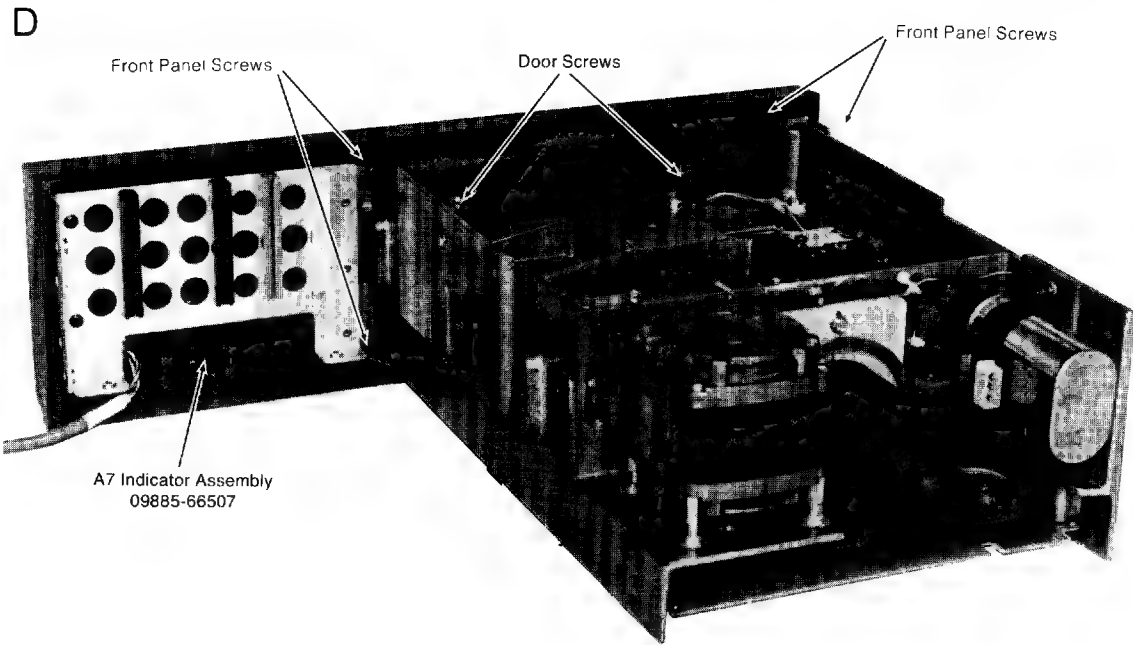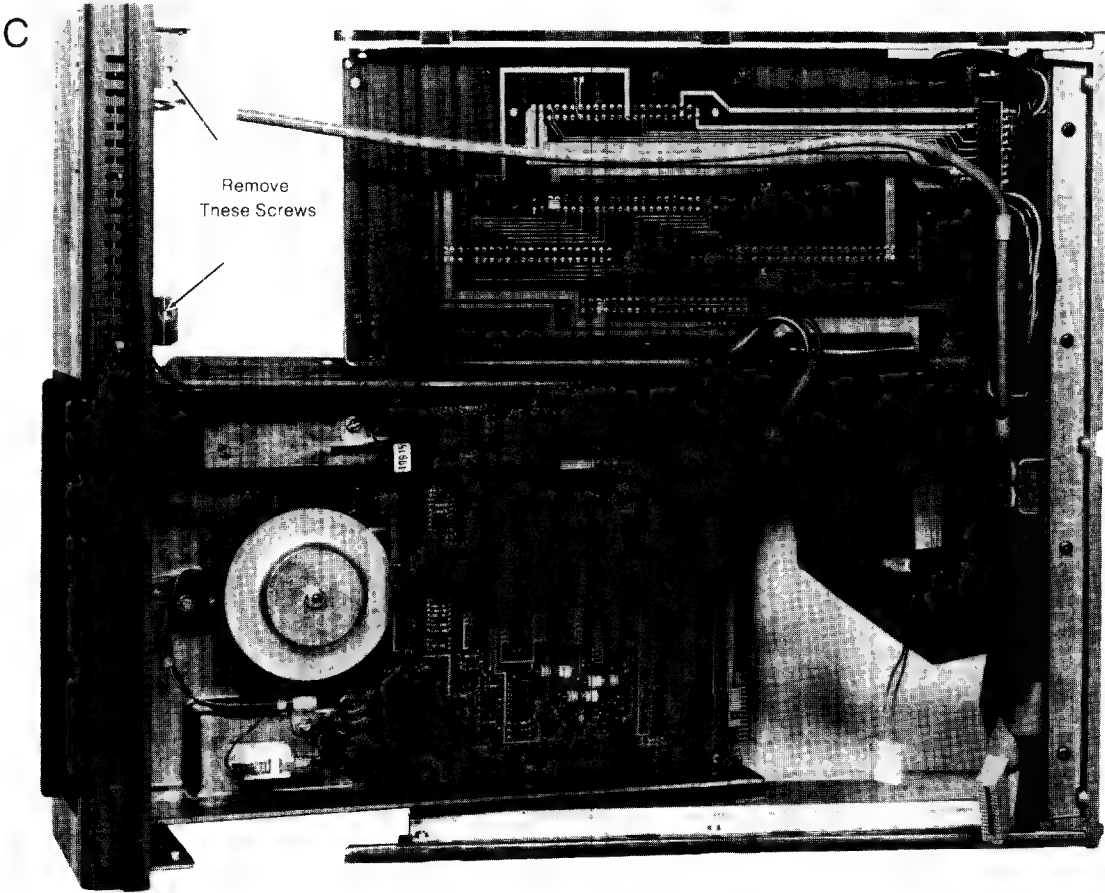
Drive and Front Panel Removal

A5 Removal

1. Remove the connectors that connect to the A5 assembly.
2. Remove the four screws holding the A5 assembly to the drive (see figure B on page 4-3).

Drive Assembly Removal

Drive Motor Assembly Removal

The drive motor and capacitor are one assembly (see figure on page 4-4).

1. Remove the A5 assembly.
2. Remove the two screws holding the capacitor clamp to the drive casting.
3. Remove the belt from the drive pulley.
4. Remove the four screws (on the bottom of the drive casting) holding the motor to the drive casting and remove the motor.
5. Disconnect the drive motor connector.
6. When installing the motor assembly, ensure that the ground lead is installed between the capacitor clamp and the drive casting.

Disk Guide Removal

1. Using a rubber band or tape, restrain the head load arm to prevent damage to the head and load arm.
2. Loosen the two door screws to free the guide from the door.

Index LED

Door Closed
Spring is Under This Plate

Disk Guide

Head Load Actuator

Spring Clip

Pivot Clip

C Clip

Write Protect Detector Removed
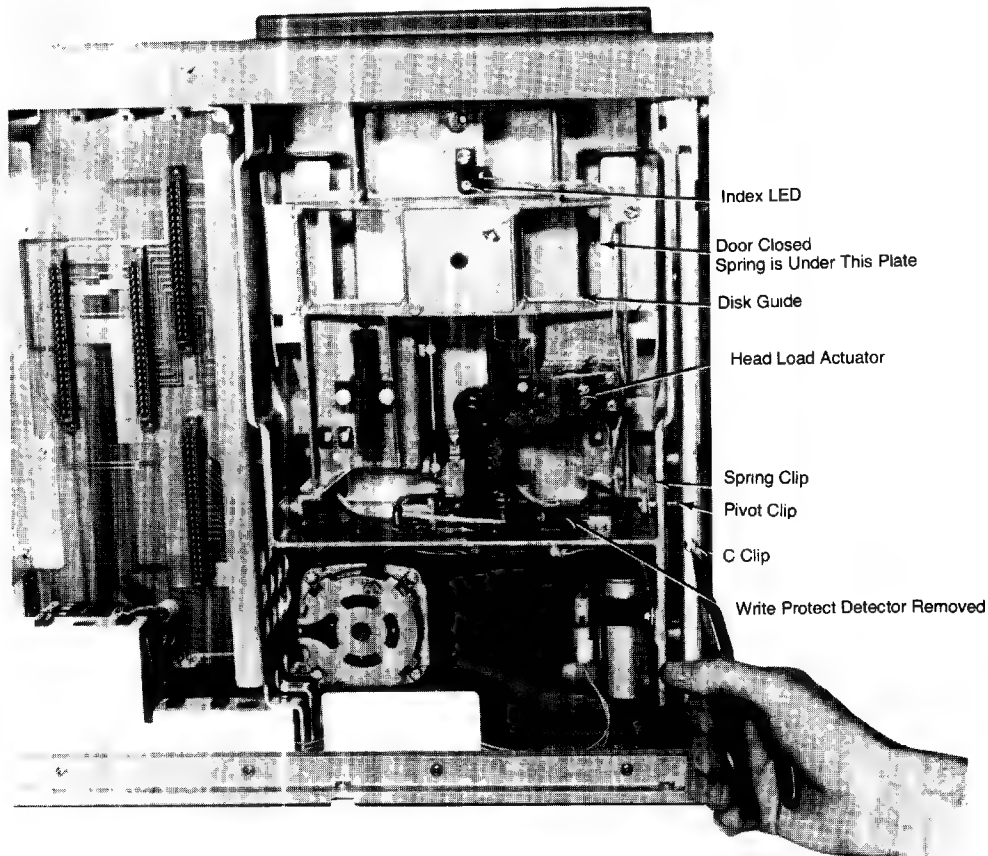
Removing the Disk Guide

3. Remove the write protect detector.

4. Using needlenose pliers, remove the C-clip from the pivot shaft and remove the shaft.

5. Remove the disk guide and the spring clip.

6. When exchanging the disk guide, it is also necessary to remove the index LED and the head load actuator.

7. Perform the disk guide adjustment when installing the guide. Ensure that the spring on the door closed switch is properly installed when replacing the guide.

8. Perform the Write Protect Adjustment.

Drive Motor Pulley Removal

1. Remove the A5 assembly.

2. Loosen the set screw and remove the pulley.

Write Protect Detector Removal

1. Remove the A5 assembly.

2. Remove pins 3,4,E and J from A5 P5.

3. Remove the cable clamp which the wires go through.

4. Remove the screw holding the detector bracket and remove the detector (see figure on page 4-4).

5. To reinstall, connect the wires as follows:

   Red — pin 3
   Gray — pin 4
   Black — pin E
   White — pin J

6. Perform the Write Protect Adjustment.

Head Load Actuator Removal

1. Unsolder the two wires on the actuator terminals.

2. Remove the disk guide.

3. Remove the screw that holds the actuator to the guide.

4. Perform the Disk Guide Alignment and the Head Load Adjustments.

Index Detector Removal

1. Disconnect P5 from the A5 assembly.

2. Remove the wires from the door closed switch (see the next figure).

3. Extract pins 6,9,B and H from P5.

4. Remove the cable clamp holding the detector wires.

5. Remove the screw holding the detector to the drive casting and remove the detector.

6. To reinstall, connect the wires as follows:

    Orange — pin B
    Brown — pin H
    Red — pin 6
    Black — pin 9

7. Perform the Index Adjustments when reinstalling.
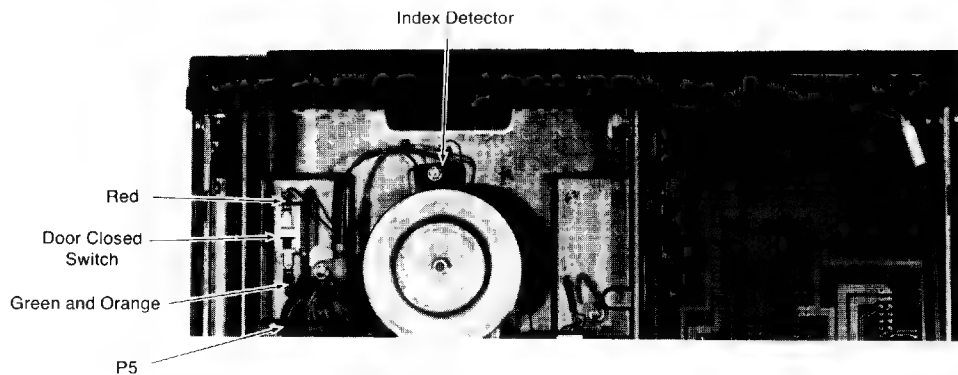
Removing the Index Detector

Index LED Removal

1. Unsolder the two wires connecting to the index LED.

2. Remove the screw holding the index LED assembly and remove the assembly.

Spindle Assembly Removal

1. Remove the disk guide and the drive belt.

2. Remove the nut and washer holding the spindle pulley.

CAUTION

THE PRE-LOADED REAR BEARING MAY FLY OUT WHEN
THE SPINDLE PULLEY IS REMOVED.

---

3. Pull the spindle hub out from the top of the drive.

4. When installing, tighten the nut to 20 in-lbs.

Hub Clamp Removal

1. Remove the two screws holding the hub clamp plate.

2. Remove the hub clamp and spring.

Stepper/Carriage Assembly Removal

Removal

1. Remove the A5 assembly. Remove the clamp holding the read/write head cable (blue) to the bottom of the drive.

A

Motor Clamp

Motor Clamp Screws

Do not loosen
these screws

Access Buttons

B

Lead Screw   Read/Write Head Cable   Stepper Motor

Carriage Assembly
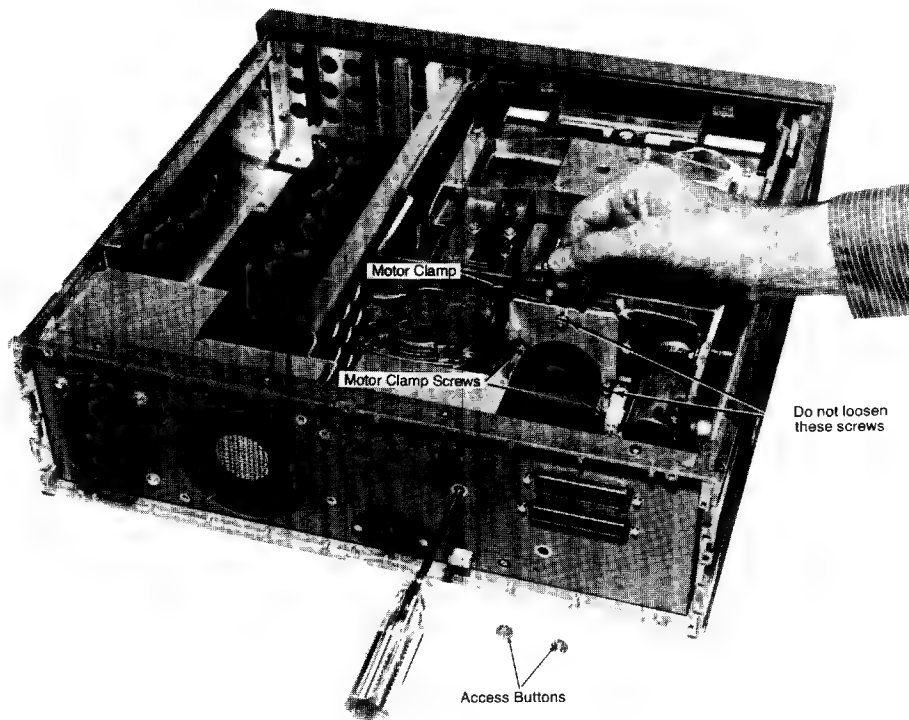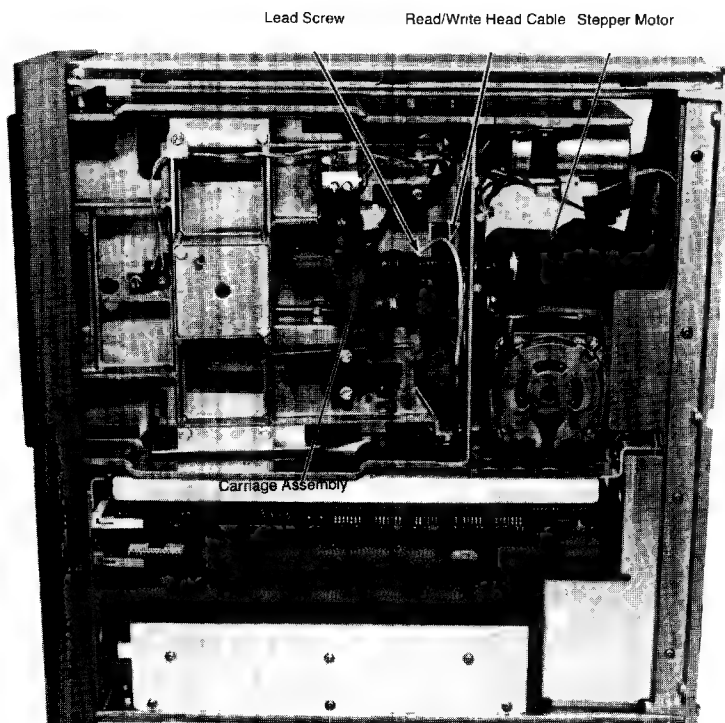
Stepper/Carriage Removal

2. If the stepper motor is to be replaced, remove the stepper motor cable pins on A5 P5. Extract pins 2 (red), 5 (brown), 8 (orange), and 10 (black). Remove the cable clamp.

3. Remove the two access buttons on the rear panel.

4. Loosen the two motor clamp screws and swing the clamp away from the motor (see the next figure).

CAUTION

THE STEPPER MOTOR MOUNTING PLATE IS ALIGNED AT THE FACTORY. DO NOT LOOSEN THE THREE FAC- TORY SEALED SCREWS.

---

5. Remove the rubber grommet on the read/write head cable from its slot on the casting.

6. Turn the stepper motor until the carriage runs off the end of the lead screw. Remove the motor through the bottom of the drive.

Installation

7. If installing a new carriage, set the pre-load nut in notch 2 (see figure below).

8. When threading the lead screw into the carriage, press the pre-load nut slightly against the spring before engaging the lead screw in the threaded portion of the carriage. The gap between the pre-load nut and the rear of the carriage can vary depending on how the lead screw is threaded into the carriage. The gap should be approximately 1/16". After assembling, ensure that there is a gap between the pre-load nut and the rear of the carriage.
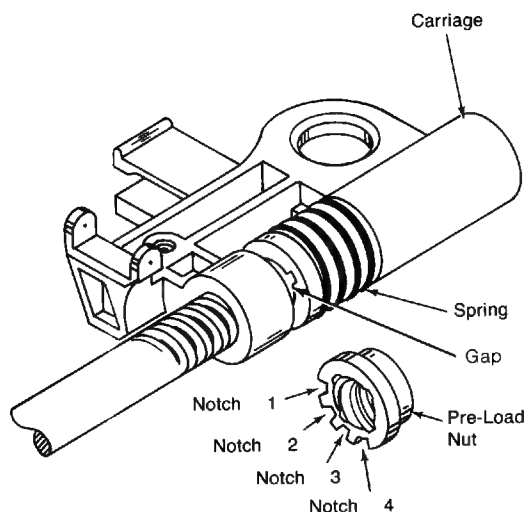
Setting the Pre-load Nut

9. Perform the Carriage Adjustment.
10. Perform the Head Radial Adjustment.
11. Perform the Azimuth Adjustment.
12. Perform the Track 0 Stop Adjustment.
13. Perform the Track 0 Flag Adjustment.
14. Perform the Index Adjustment.

Head-load Button Removal

1. Hold the head-load arm out away from the head.
2. To remove the button, squeeze the locking tabs together with a pair of needlenose pliers and press forward.
3. To install a button, press the button into the arm from the head side until it snaps into place.
4. Perform the Head-load Button Adjustment.

NOTE

When making adjustments, ground the oscilloscope probes to the A5 PC assembly. Chassis is not ground for logic signals.

Mechanical Adjustments

Mechanical adjustments usually have to be made after an associated mechanical part has been replaced or removed for maintenance. All adjustments are made with the 9885 disconnected from the system and the Disk Service Fixture installed.

The various mechanical adjustments are summarized here.

Mechanical Adjustments

Adjustment	Perform
Write Protect	After replacing or moving the write protect detector or the write protect LED.
Head Load Actuator Head Load Timing	After replacing the head load actuator (new) or head.
Index	After replacing or moving the index detector, the index LED, or Head.
Disk Guide	After moving the disk guide or replacing it.
Carriage	After stepper motor or carriage replacement.
Head Alignment	After installing the stepper motor or carriage.
Head Load Button	After installing new load button or head.
Track 0 stop and flag	After installing the carriage, the track 0 detector, or head.
Head Azimuth	After installing stepper motor or carriage.

Adjustments Required

Here is a summary of the adjustments to perform when replacing some of the more common drive assemblies.

Replace track 0 detector (0955-0088)

1. Check head radial alignment
2. Adjust track 0 flag
3. Adjust track 0 stop

Replace index LED (1150-1313) and/or index phototransistor (1150-1316)

1. Adjust index potentiometer
2. Adjust index timing

Replace head-load actuator (disk guide removed) (1150-1311)

1. Adjust disk guide
2. Adjust head load actuator
3. Adjust head load timing
4. Adjust write protect

Replace head-load button (1535-3648)

1. Adjust load button
2. Check head amplitude

Replace carriage (1150-1315) and/or stepper assembly (3140-0582)

1. Adjust carriage
2. Head Radial Alignment
3. Adjust load button
4. Adjust track 0 flag
5. Adjust track 0 stop
6. Adjust index
7. Check head amplitude
8. Check azimuth adjustment

Equipment Required

In addition to the tools required for assembly access, the following equipment is required to make the adjustments —

- Voltmeter: DC volts 1% accuracy

- Oscilloscope:
    horiz — 50 μsec/cm
    vert — dual trace amplifier (5 mv/cm)

- Disk Service Fixture

- Alignment Disk

- Disk Guide Alignment Tool

- Head-load Alignment Tool

- Three (10:1) Scope Probes

Disk Service Fixture

The Disk Service Fixture (DSF) allows you to service and align the 9885 while it's disconnected from the system. To use the DSF, first remove the A3 and A4 assemblies from the 9885 and set the drive select switch to 3. Then plug the DSF onto the lower I/O connector on the back of the drive. Connect the wire coming from the DSF to +5 V (e.g., test point 9 on the A5 board).
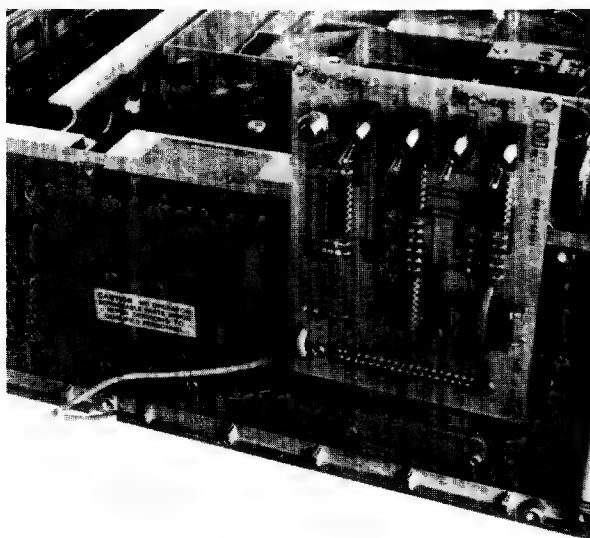
The DSF
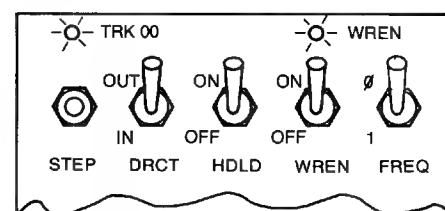
DSF Switches

Pressing the **STEP button** will step the carriage in or out one track position, depending on the direction switch setting. If the button is held down, the carriage will continuously step in the specified direction until either track 77 or track −1 is reached.

The **DRCT switch** controls the direction of carriage movement. If the switch is up (OUT position), the carriage will move towards track 0 when the step button is pressed. If the switch is down (IN position), the carriage will move towards track 77 when the STEP button is pressed.

The **TRK 00 indicator** will light when the track 0 flag is detected and the stepper motor phase 1 winding is energized.

The **HDLD load switch** loads and unloads the read/write head. The head must be loaded to read from or write on the disk.

The **WREN switch** enables you to write on the disk. If the switch is ON, write is enabled. If the switch is OFF, read is enabled. The WREN indicator is lit when write is enabled.

When write is enabled, 0's or 1's can be written on the disk. Position the **FREQ switch** to the 1 or 0 position for the appropriate pattern.

Alignment Disk

The alignment disk is a prerecorded disk used in drive alignment.

Track 0 is recorded with a standard format which is used for aligning the head.

Track 38 is recorded with a "cats eye" pattern used for aligning the head.

Tracks 1 and 76 are used in the Index Adjustment.

Track 75 is used in the Load Button Adjustment.

Track 76 is used in the Head Azimuth Adjustment.

NOTE

Do not write on the alignment disk; writing can destroy the prerecorded tracks.

Write Protect Adjustment

This adjustment ensures that the write protect signal is at its maximum value when a protected disk is inserted in the drive.

1. Insert a disk into the drive. The write protect hole must be open.

2. Connect channel A of the oscilloscope to the signal side of R71 on A5. Set up the scope as follows:

   horizonal time base $-$ 100 μsec/cm
   vertical amplifier $-$ .2 V/cm
   input $-$ DC .
   sync $-$ INT
   display $-$ A

3. Loosen the screw on the write protect detector and move the detector until maximum amplitude is seen on the scope.

4. Tighten the screw.

Head Load Actuator Adjustment

This adjustment ensures the proper mechanical clearances are met when the head load actuator is energized (head loaded) and deenergized (head unloaded).

1. Remove the disk and close the door. Energize the head load coil.

2. Place the head load tool on the drive casting (see figure below).

3. Adjust the down stop so that the top of the head load bail is flush with the top of the tool ($\pm$.005").

4. Step the carriage to track 38 and de-energize the head load coil (turn drive off).

5. Place the adjustment tool onto the read/write head and place the load button in the cup of the tool.

6. Adjust the up stop on the actuator so that the bail just touches the head load arm ($\pm$.005").

7. Energize the head load coil and manually step the carriage from track 0 through track 76. Ensure that there is at least .01" clearance between the head load bail and the head load arm.

A

Head Load Button — Read/Write Head

Head Load
Bail
Head Load
Actuator

Head Load Arm —

B

Up Stop Adjustment Screw

Load Bail just touches Head Load Arm

Head Load Arm

Load Bail Gauge

Read/Write Head

Load
Bail

Up Stop Adjustment

C

Down Stop Adjustment Screw

Top of guage flush with load bail

Load Bail

Drive Casting —

Load Bail Guage
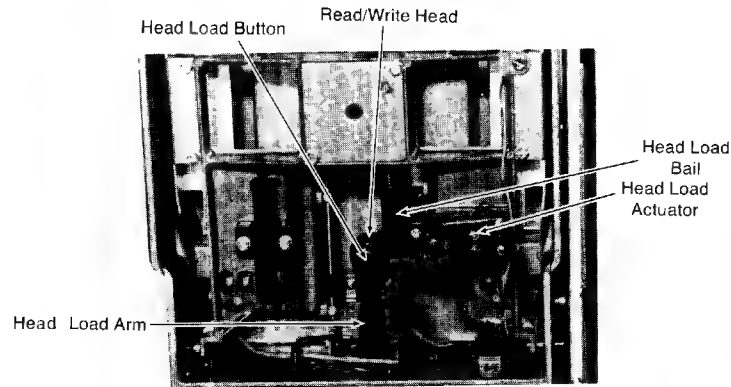
Down Stop Adjustment
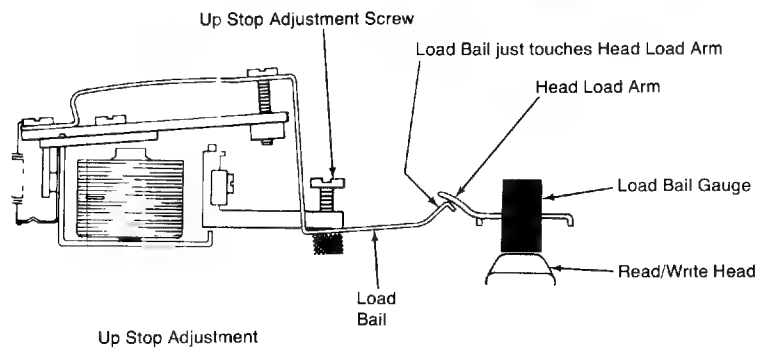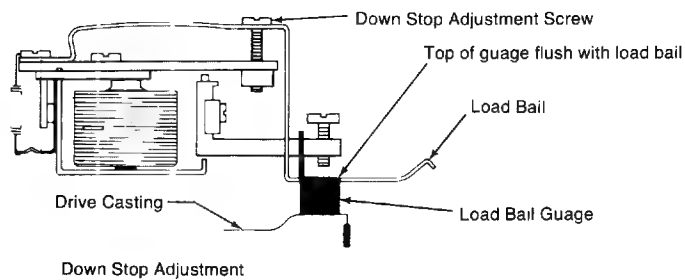
Head Load Stop Adjustments

Head Load Timing

This adjustment ensures that the head is loaded and full read amplitude is present within 35 milliseconds after the head load signal is sent.

1. Insert the alignment disk.

2. Step the carriage to track 0.

3. Set up the oscilloscope as follows:

    horizontal time base — 5 msec/cm
    vertical amplifier — .2 V/cm
    input — DC
    sync — EXT+
    display — A+B, B inverted

4.   Connect the scope probes as follows:

Channel A − A5TP10
Channel B − A5TP11   (read preamplifier)
sync − head load actuator (blue wire)

5.   Energize the head load coil and observe the read signal (see below). The signal must be at full amplitude within 35 milliseconds. If not, proceed with step 6.

6.   Check the head load actuator adjustments. If the adjustments are correct, adjust the down stop screw clockwise until the timing is within specs.

NOTE

Do not exceed 1 / 4 turn on the down stop screw.
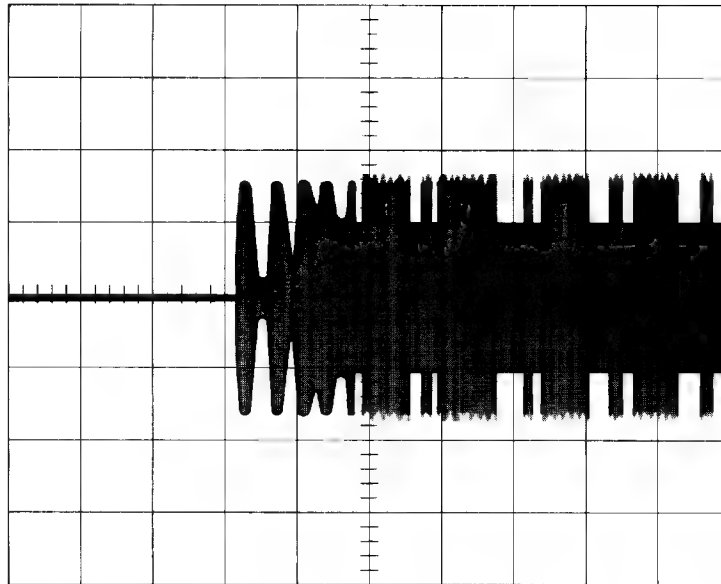
Head Load Timing Waveform

Index Adjustment

This adjustment ensures that the index pulse occurs before the start of the sector 0 data.

1.   Insert the alignment disk.

2.   With an oscilloscope, monitor A5TP4 (Index). Set the scope as follows:

horizontal − .5 msec / cm
vertical amplifier − .2 V / cm
input − DC
sync − INT
display − A

3. Adjust the index potentiometer on the index phototransistor to obtain a 1.7 msec pulse ±.5 msec (see below).

4. Step the carriage to track 1.

5. Set the oscilloscope as follows:

   horizontal time base — 50 μsec/cm
   vertical amplifier — 100 mv/cm
   input — AC
   sync — EXT+, DC or ACF
   display — A+B, B inverted

6. Connect the sync probe to A5TP4 (Index).
   Connect channel A to A5TP10
   Connect channel B to A5TP11   (read preamplifier)

7. The timing between the start of the sweep and the first data pulse should be 200 ± 100 μsec (see figure on next page). If the timing is not in tolerance, continue with this procedure.

8. Loosen the screw holding the index phototransistor assembly about 1/8 turn.

9. Carefully move the assembly (tap it lightly) until the timing in step 7 is met; then tighten the screw. Move it clockwise to increase.

10. Step the carriage to track 76 and verify that the timing is 200 ± 50 μsec. If timing is out of tolerance, do the head azimuth adjustment.
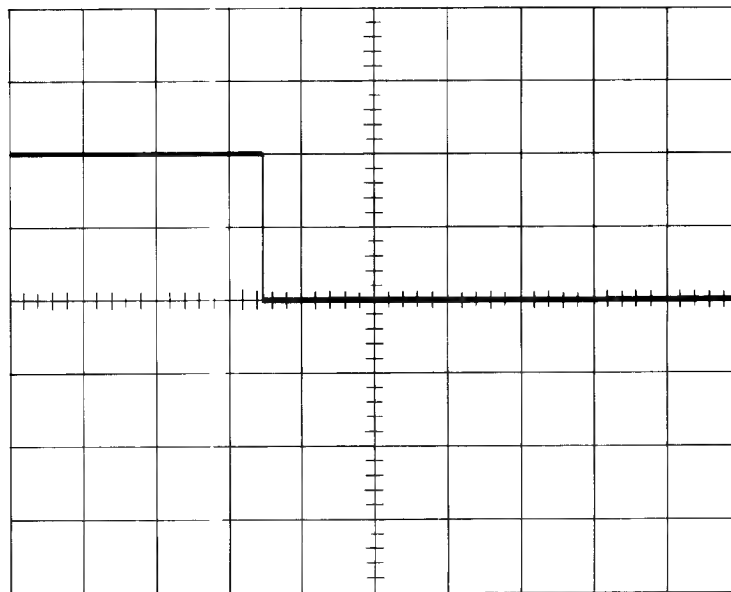
Index Pulse Waveform
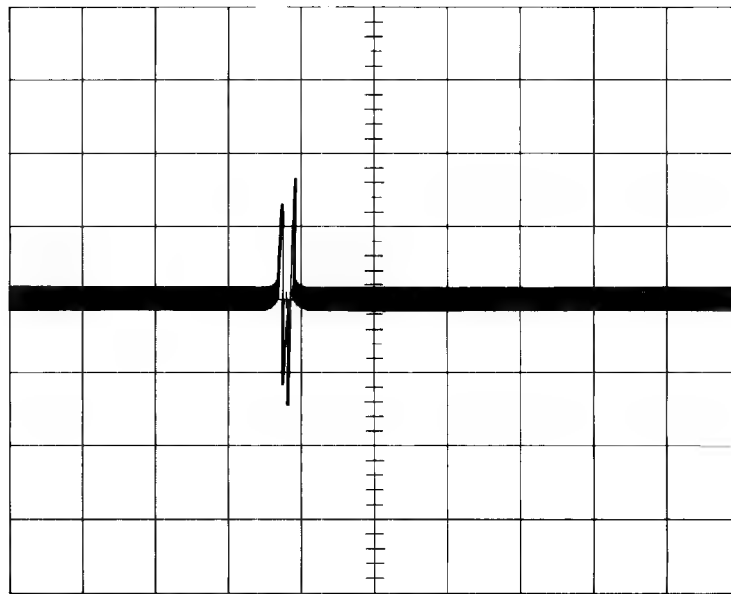
Index Timing Waveform

Head Azimuth Adjustment

This adjustment realigns the read/write head to track perpendicular to the disk.

1. Install the alignment disk.

2. Step the drive to track 76.

3. Sync the scope positive on TP4 and set the time base to .2 ms/cm.

4. Connect one scope probe to TP10 and the other to TP11. Invert one channel, ground the probes, and center the beams. Now set the inputs to ac and .1 mv/cm.

5. Compare the waveform to that shown next. The amplitude of the 1st and 4th sectors must be equal to or less than sectors 2 & 3 for the azimuth to be acceptable. The figure shows a perfect alignment of zero minutes. (0°0') If the waveform is not as shown, the head azimuth requires adjustment: continue with this procedure.

6. Locate the two factory-sealed screws on the bottom of the stepper motor mounting plate (see the next figure). Carefully loosen each screw 1/8 turn.

CAUTION

DO NOT LOOSEN THE TOP FACTORY-SEALED SCREW ON THE STEPPER MOTOR, SINCE THAT WILL REQUIRE FAC-TORY REALIGNMENT!

SECTOR 2   SECTOR 3

SECTOR 1   SECTOR 4
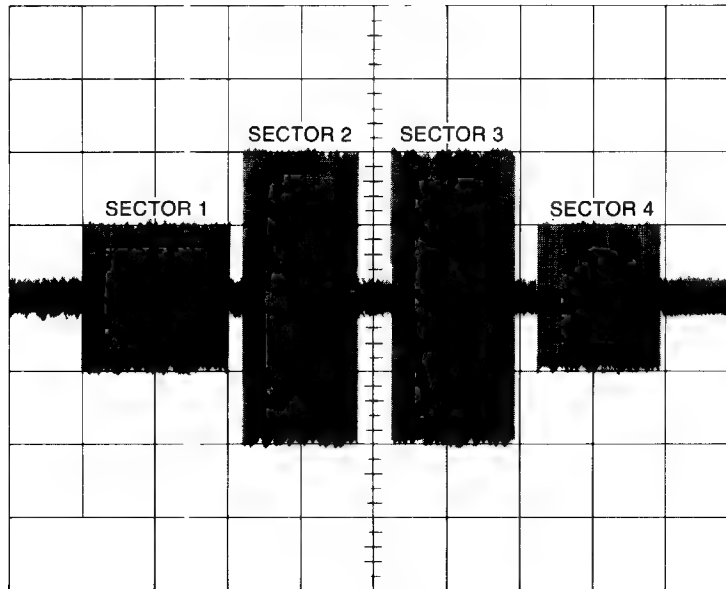
Head Azimuth Waveform

7. Carefully move the stepper motor to the right or left, until the waveform is acceptable (the middle sectors must be greater than or equal to the outside sectors).

8. Re-tighten the screws. If either of the outside sectors increase in amplitude greater than either of the inside sectors after re-tightening the screws, perform the adjustment again.

9. Check the index timing and head radial adjustment and readjust if required.
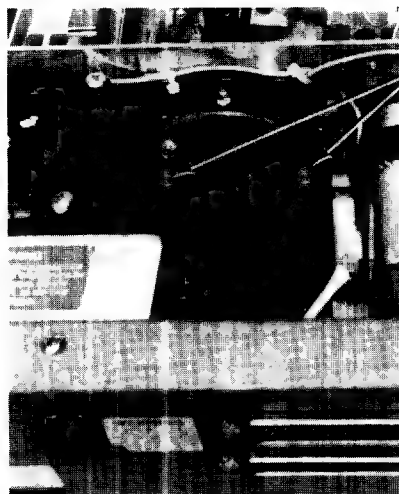
Loosen These Screws

Stepper Motor Mounting Screws

Disk Guide Alignment

This adjustment ensures that there is enough clearance between the disk guide and the flexible disk when the disk is installed.

1. Insert the disk guide alignment tool through the adjustment hole in the disk guide (see next figure) and screw it into the base casting (hand tighten).

2. Move the door to the latched position and hold it up against the latch.

3. Tighten the two screws to hold the disk guide to the door. Check to see that the door is straight.

4. Remove the tool and ensure that the hub clamp does not rub on the disk guide when the spindle is rotating.

5. If the hub clamp rubs, repeat the procedure.

6. Check the index alignment.

7. Insert a disk; close and open the door and check for proper operation.
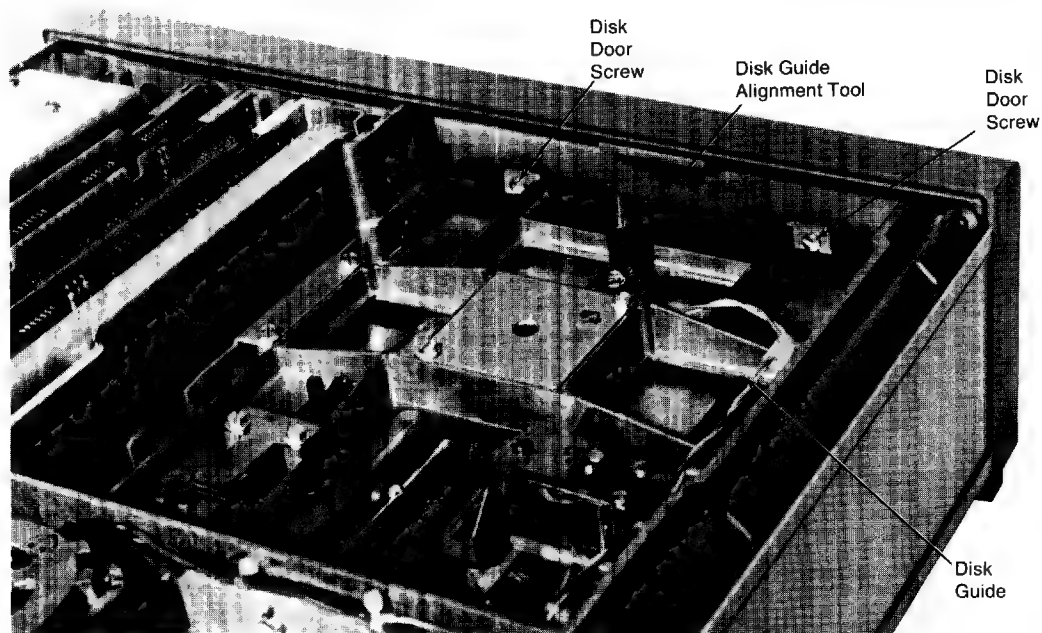
Disk Guide Adjustment

Carriage Adjustment

This is a rough adjustment which is done when the carriage assembly is replaced. This adjustment is in preparation for the Head Radial Alignment.

1. Loosen the stop collar lock screw and manually rotate the lead screw to move the carriage towards the stepper motor, until the head load arm tab is near the end of the load bail and the back of the load arm is flush with the casting. Tighten the collar set screw.

2. Position the track 0 tab approximately in the center of its slot in the track 0 detector and tighten the screw (see below).
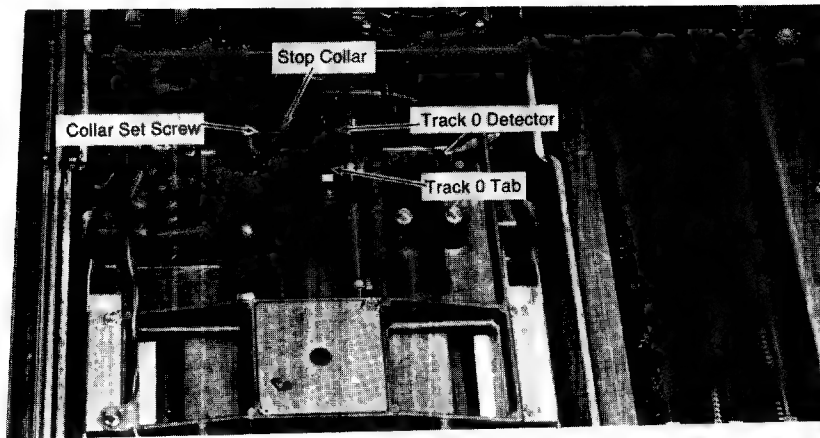
Carriage Adjustment

3. Move the carriage out towards the spindle until the tab is clear of the track 0 detector.

4. Set the oscilloscope as follows:

    horizontal time base − 5 msec/cm
    vertical amplifier − .2 V/cm
    input − AC
    sync − EXT.+, DC
    display − A+B, B inverted

5. Insert the alignment disk and load the head.

6. Step the carriage back until the TRK 00 lamp on the DSF lights.

7. Connect the sync probe to A5TP4 (Index).
   Connect channel A to A5TP10
   Connect channel B to A5TP11   (read preamplifier)

8. Loosen the two stepper motor mounting screws and rotate the stepper motor case until the track 0 data appears on the scope (see below). Rotate until maximum amplitude is obtained and tighten the mounting screws. This is only a rough adjust-ment.
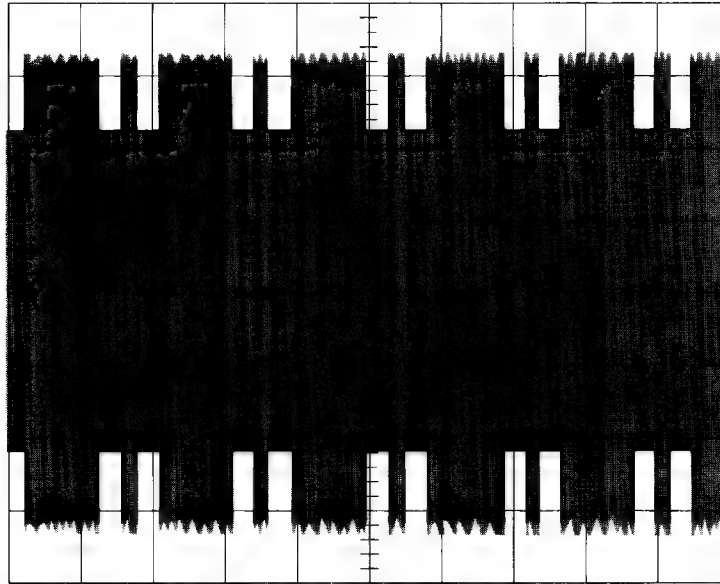
Track 0 Data Pattern

CAUTION

DO NOT LOOSEN THE THREE FACTORY SEALED SCREWS OR YOUR EAR WILL FALL OFF.

Head Radial Alignment

This adjustment ensures that the read / write head is aligned to read the center of a desired track. When this adjustment is done properly, the drive will be compatible with other drives.

NOTE

This alignment should be checked before adjusting in-dex, track 0 flag and track 0 stop.

---

1. Load the alignment disk. The disk should be at room temperature for at least twenty minutes before alignment.

2. Step the carriage to track 38.

3. Set up the oscilloscope as follows:

   horizontal time base − 20 msec/cm
   vertical amplifier − .1 V/cm
   input − AC
   sync − EXT+, DC
   display − A+B, B inverted

4. Connect the sync probe to A5TP4 (Index).
   Connect channel A to A5TP10
   Connect channel B to A5TP11   (read preamplifier)

5. The lobes on the waveform shown on the oscilloscope should be equal in amplitude, or the right lobe can be up to 5% larger.

6. Loosen the two stepper motor mounting screws.

CAUTION

DO NOT LOOSEN THE THREE FACTORY SEALED
SCREWS.

---

7. Rotate the stepper motor until the amplitude of the lobes is the same. Tighten the motor screws.

8. Check the alignment by stepping from track 38 and then returning to it. Do this from both directions, re-adjust the stepper motor if necessary. The waveform may be slightly different (see step 5 above).

9. Perform the track 0 flag and stop adjustments. Then do the Index Adjustment.
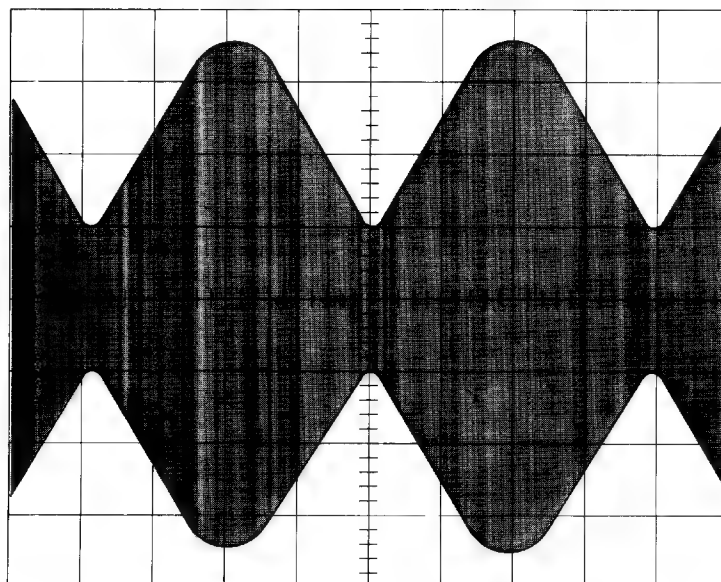
Head Alignment Waveform

Track 0 Flag Adjustment

This adjustment ensures that the track 0 signal is high (true) on tracks 0 and 1, and low (false) on other tracks.

1. Check the Head Radial Adjustment before making this adjustment.

2. Set the oscilloscope as follows:

   horizontal time base — 20 msec/cm
   vertical amplifier — .2 V/cm
   input — DC
   sweep — auto
   display — A

3. Step the carriage to track 1; the voltage on A5TP3 should be high (+5 volts).

4. If not high, loosen the track 0 tab screw and move the tab towards the stepper until A5TP3 just goes high. Tighten the screw.

5. Check the adjustment by stepping the carriage between tracks 0 and 2. TP3 should be high at tracks 0 and 1, and low at track 2.

Track 0 Stop Alignment

This adjustment sets a mechanical stop for the carriage assembly to prevent damage to the assembly. The Head Radial Alignment should be correct before performing this adjustment.

1. Step carriage to track 0.

2. The distance between the back of the carriage and the stop collar should be .040" ± .020" (see the next figure). Loosen the collar set screw and slide the collar until the distance is met. Tighten the set screw.

3. Switch the drive off and manually rotate the lead screw clockwise until the carriage stops. In this position, the distance between the carriage and collar should be .020" ± .010".

4. If clearances in steps 2 and 3 are not met, proceed with this procedure.

5. Loosen the stop collar.

6. Switch the drive on and step the carriage to track −1.

7. Position the stop collar until the stop contacts the carriage stop surface. Tighten the screw.

9. Set the oscilloscope as follows:

    horizontal time base — 20 msec/cm
    vertical amplifier — .2 V/cm
    input — AC
    sync — EXT+
    display — A+B, B inverted

10. Connect the sync probe to A5TP4 (Index).
     Connect channel A to A5TP10
     Connect channel B to A5TP11   (read preamplifier)

11. Step the carriage to track 0. Check the track 0 data pattern with the scope.

12. Step the carriage between track 0 and 76. Check for binding and head cable inter-
     ference.
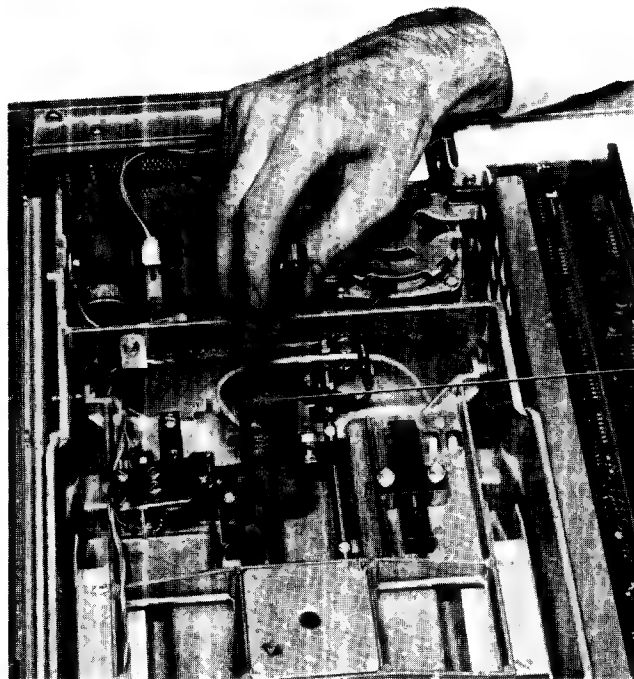
Space between back of
carriage and stop collar:

At Track 0 .040" ± .020"
At Mechanical Stop .020" ± .010"
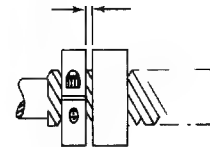
Track 0 Stop Adjustment

Head-load Button Adjustment

This adjustment ensures that the head load button is positioned so that maximum amplitude is obtained from the read/write head.

1. Insert alignment disk.

2. Set the oscilloscope as follows:

   horizontal time base − 20 msec/cm
   vertical amplifier − 50 mv/cm
   input − AC
   sync − EXT+
   display − A+B, B inverted

3. Connect the sync probe to A5TP4 (Index).
   Connect channel A to A5TP10
   Connect channel B to A5TP11   (read preamplifier)

4. Step to track 75.

5. Rotate the load button 10° at a time until maximum amplitude is obtained.

Electrical Checks and Adjustments

Power Supply Voltages

The various voltages in the 9885 should be checked for proper values. The test points used to check each voltage are shown below. The +5 V supply is adjustable.
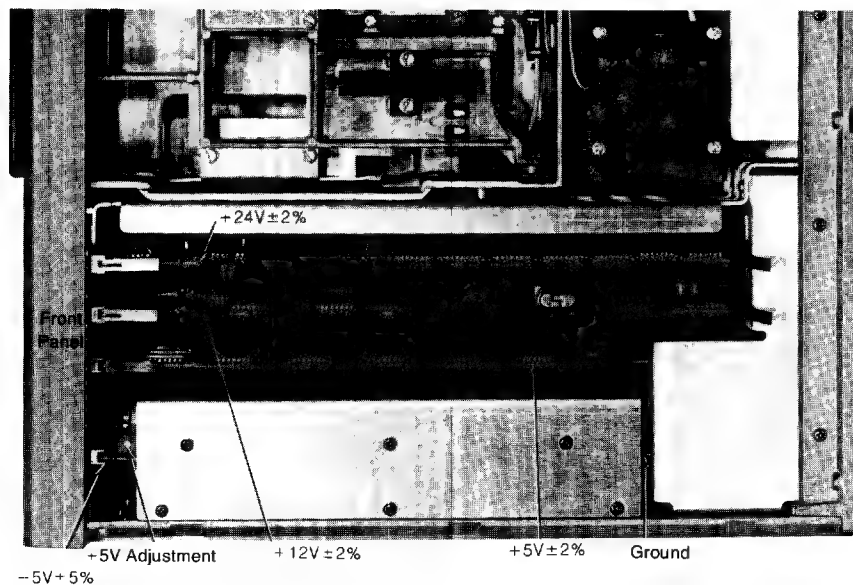
Power Supply Test Points

Head Amplitude Check

This check verifies that the read signal amplitude is sufficient to avoid read errors.

1. Install a known good disk.

2. Step to track 76.

3. Set the oscilloscope as follows:

   horizontal time base — 2 msec/cm
   vertical amplifier — 10 mv/cm
   input — AC
   sync — EXT+
   display — A+B, B inverted

4. Connect the sync probe to A5TP4 (Index).
   Connect channel A to A5TP13
   Connect channel B to A5TP14   (read preamplifier)

5. Write all ones on track 76.   Then set the WREN switch to OFF.

6. The average minimum read back amplitude should be 120 mv peak to peak (see below). If this amplitude is below the minimum specified, the load pad should be replaced and the head should be cleaned if necessary before rewriting and re-checking. If the output is still low, it will be necessary to install a new head and carriage assembly.

7. Write all zeros on track 76.   Then set the WREN switch to OFF.

8. The ratio of the amplitude with zeros to the amplitude with ones should be less than 3.

$$\text{i.e.,} \quad \frac{\text{Zero Amplitude}}{\text{One Amplitude}} < 3$$
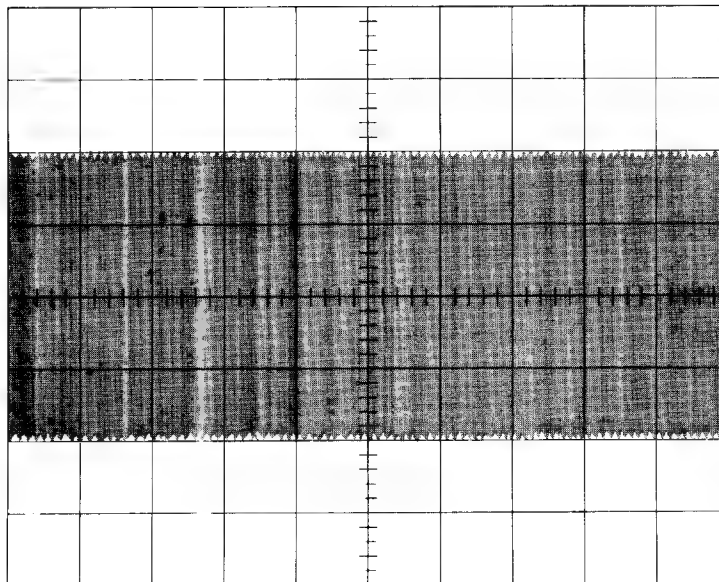
Head Amplitude Waveform

Read Amplifier Balance

This adjustment ensures that the read amplifier is properly balanced. This adjustment should be checked when the A5 assembly or read/write head is changed, and during a normal PM procedure.

1. Install a known good disk.

2. Step to track 66.

3. Set the oscilloscope as follows:

   horizontal time base − .5 μsec/cm
   vertical amplifier − .2 V/cm
   input − DC
   sync − internal −
   display − A

4. Connect channel A to the digital read signal, TP2 on A5.

5. Write all 1's on track 66.

6. Read track 66. Adjust R17 so the center pulse is converged to one pulse (see the next figure).
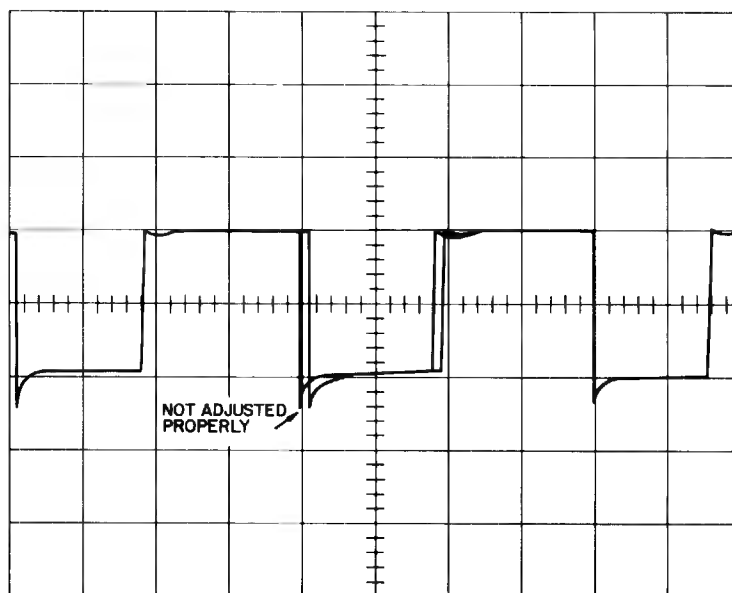
Read Amplifier Balance

Chapter **5**

Troubleshooting

Isolating the Problem

Unless visual inspection of the drive discloses an obvious misalignment or broken parts, first attempt to repeat the fault with the original disk, then attempt to duplicate the fault on a second disk. You can use the Checkread test described later with desktop computers to exercise the drive without erasing data.

Remember that incorrect operating procedures, faulty programming, damaged disks, and "soft errors" created by airborne contaminants, random electrical noise, and other external causes can produce errors which are falsely attributed to drive failure or misadjustment.

Soft Errors

Soft errors are usually caused by —

- Airborne contaminants that pass between the read/write head and the disk. Usually these contaminants can be removed by the cartridge self-cleaning wiper on the inside of the envelope.

- Random electrical noise that usually lasts for a few microseconds.

- Small defect in the written data and/or track that may cause a soft error during a read.

- Worn or defective load pad.

Troubleshooting with Self Test

To isolate a problem using the internal self test, first disconnect the 9885M from the computer interface cable. All the drives in the system must be switched on with the disk doors closed. At this time disks should not be installed in the drives. With these initial conditions set, use the self test troubleshootng flowcharts on the next page.

CAUTION

PERFORMING THE SELF TEST WITH A DISK INSTALLED
WILL ERASE DATA ON TRACKS 0 AND 66. USE A BLANK
(NON-INITIALIZED) DISK FOR THE SELF TEST.

SINGLE DRIVE SYSTEM

```
                    START
                      │
                      ▼
              ┌───────────────┐
              │  PRESS THE    │
              │  TEST SWITCH  │
              └───────────────┘
                      │
                      ▼
               INDICATOR   NO    ┌──────────┐
               OUT < 1 MIN ────► │ CONTROL  │
                   ?             │ PROBLEM  │
                      │          │  A2-A4   │
                    YES          └──────────┘
                      ▼
              ┌───────────────┐
              │  CONTROLLER   │
              │     IS        │
              │   WORKING     │
              └───────────────┘
                      │
                      ▼
              ┌───────────────┐
              │   INSERT A    │
              │ KNOWN GOOD    │
              │    DISK       │
              └───────────────┘
                      │
                      ▼
              ┌───────────────┐
              │  PRESS THE    │
              │  TEST SWITCH  │
              └───────────────┘
                      │
                      ▼
               INDICATOR   NO    ┌──────────┐
               OUT < 1 MIN ────► │ TRY 1 MORE│
                   ?             │ GOOD DISK │
                      │          └──────────┘
                    YES               │
                      ▼               ▼
              ┌──────────┐     ┌───────────────┐
              │ DRIVE IS │     │  PRESS THE    │
              │FUNCTIONAL│     │  TEST SWITCH  │
              └──────────┘     └───────────────┘
                                      │
                                      ▼
         ┌───────────┐  NO     INDICATOR
         │   DATA    │ ◄───── OUT < 1 MIN
         │ELECTRONICS│            ?
         │A5 OR DRIVE│            │
         │   BAD     │          YES
         └───────────┘            ▼
                           ┌──────────┐
                           │ THE FIRST│
                           │ DISK IS BAD│
                           └──────────┘
```

MULTIPLE DRIVE SYSTEM

```
                    START
                      │
                      ▼
              ┌───────────────┐
              │  PRESS THE    │
              │  TEST SWITCH  │
              └───────────────┘
                      │
                      ▼                    ┌──────────────────┐
               INDICATOR   NO              │DISCONNECT 1 DRIVE│
               OUT < 1 MIN ──────────────► │   AT A TIME AND  │
                   ?                        │ PRESS THE TEST   │
                      │                     │ SWITCH AFTER EACH│
                    YES                     │    DRIVE IS      │
                      ▼                     │  DISCONNECTED    │
              ┌───────────────┐             │ UNTIL DEFECTIVE  │
              │   INSERT A    │             │DRIVE IS ISOLATED │
              │   DISK IN     │             └──────────────────┘
              │  ALL DRIVES   │
              └───────────────┘
                      │
                      ▼
              ┌───────────────┐
              │  PRESS THE    │
              │  TEST SWITCH  │
              └───────────────┘
                      │
                      ▼                    ┌──────────────────┐
               INDICATOR   NO              │DISCONNECT 1 DRIVE│
               OUT < 1 MIN ──────────────► │   AT A TIME AND  │
                   ?                        │ PRESS THE TEST   │
                      │                     │ SWITCH AFTER EACH│
                    YES                     │    DRIVE IS      │
                      ▼                     │  DISCONNECTED    │
              ┌───────────────┐             │ UNTIL DEFECTIVE  │
              │  DRIVES ARE   │             │DRIVE IS ISOLATED │
              │  FUNCTIONAL   │             └──────────────────┘
              └───────────────┘                      │
                                                     ▼
                                            ┌──────────────────┐
                                            │  EXCHANGE DISKS  │
                                            │ IN THE DEFECTIVE │
                                            │ DRIVE TO ENSURE  │
                                            │   DISK IS NOT    │
                                            │CAUSING PROBLEMS  │
                                            └──────────────────┘
```

Self Test Troubleshooting Trees

9825A Disk Test Programs

The 9825A Disk System Cartridge (09885-90035) contains these utility and recovery routines on each track —

File	Program
0 and 100	Initialize routine
1 and 101	Soft error recovery (binary)
2 and 102	Soft error recovery (user language)
3 and 103	Exerciser (binary)
4-9 and 104-109	Unused
10-69 and 110-169	Bootstrap routines

Operating instructions are at the back of the 9825A Disk Programming Manual (09885-90000). The initialize and exerciser routines are briefly covered here.

Initializing a Disk

Each of the exerciser routines uses an initialized disk. To initialize a blank disk, first insert the disk in the drive and close the door. Then insert the 9825A Disk System Cartridge in its transport and press ▆▆▆▆. Then execute —

```
trk0;ldb0; init
```

The routine takes about five minutes.

Running the Exerciser

The exerciser has two programmable routines for checking disk operation: the checkread (ckrd) and pattern (ptrntst) tests. The checkread test reads data on a known-good disk and compares it with a checksum previously recorded. ckrd does not erase data on the disk. The pattern test writes data patterns on the disk and then reads them back. ptrntst erases each area which is tested.

The exerciser can be used with or without the Disk ROM installed. Without the ROM, the exerciser assumes select code 8 and drive number 0. With the ROM installed, any allowable select code and drive number may be specified.

To load the exerciser, insert the Disk System Cartridge and press ▆▆▆▆. Then execute —

```
trk 0; ldb 3.
```

To run the checkread test, use the syntax − ckrd n, s, e

n = the number of test cycles. If n = 0 the test will run continuously. The cycle number is displayed after each pass.

s = starting track.

e = ending track.

Entering non-existent tracks or entering an ending track number less than the starting track number will result in an error.

The test is non-destructive. All parameters are optional, (e.g., ckrd = checkread the entire disk, ckrd 1, 3 = check track 3 once). ckrd passed is printed when the test passes.

To run the pattern test, use the syntax − ptrntst n, s, e

This test is destructive. All parameters are optional. It will run only on a disk with no files in use. If the test is attempted on a disk containing files, an error message is printed. If a system area is tested, zeros are written in the area and a message is printed that information has been destroyed. The five octal patterns used are −

$$143306$$
$$066154$$
$$155555$$
$$133333$$
$$000000$$

If a compare fail occurs during the pattern test, a compare fail message is printed listing the track, record and the failing pattern. ptrn tst passed is printed when the test passes.

An error message listing the track, record and type of error is printed for each read or write error during ckrd or ptrntst. There are no rereads or rewrites if an error occurs. ptrntst reads with a tight margin, ckrd does not. Refer to the disk errors listed next.

The error recovery routines on the Disk System Cartridge may be helpful in recovering data made inaccessible via a disk error. Those routines are described at the back of the 9825A Disk Programming Manual.

9825A Disk Hardware Errors

d0   Firmware/driver out of synchronization or more than six defective tracks in a row (press RESET).

d1   All drives in system not powered.

d2   Door opened while disk is being accessed.

d3   Disk not in drive or no such drive number.

d4   Write not allowed to protected disk or bad hardware.

d5   Record header error (use error recovery routine).

d6   Track not found (use error recovery routine).

d7   Data checkword error (use error recovery routine).

d8   Hardware failure (press RESET).

d9   Verify error due to drive problem or marginal data (reprint data).

9825A Disk Software Errors

D0   Improper argument.

D1   Argument out of range.

D2   Improper file size (negative, 0 or >32767).

D3   Invalid file name.

D4   File not found.

D5   Duplicate file name.

D6   Wrong file type.

D7   Directory overflow.

D8   Insufficient storage space on disk.

D9   Verify error due to cable, computer, or drive problem also, bad data (reprint data).

F0   File overflow when read or print executed.

F1   Bootstraps not found (reload bootstraps).

F2   String read but wrong data type encountered.

F3   Attempt to read data item but type doesn't match.

F4   Availability table overflow (repack).

F5   Attempt on end branch from other than running program.

F6   Unassigned data file pointer.

F7   Disk is down so line cannot be reconstructed.

F8   Disk is down and (STOP) pressed.

F9   System error (save files individually and reinitialize).

9831A Disk Test Programs

The 9831A System Test Cartridge (09831-90035) has two prorammable routines for testing disk operations: the checkread (CKRD) and pattern (PTRNTST) tests. Error recovery routines are available on the Utility Routines Disk (09885-10014), which also has other disk utility programs such as INIT (initialization) and BACKUP. The 9831A Disk Operating & Programming Manual (09885-90050) covers use of each utility.

Initializing a Disk

Each of the test routines uses an initialized disk. To initialize a blank disk, first insert the Utility Routines Disk into the drive and close the door. Then execute —

```
GET BIN "INIT"
```

Remove the Utility Routines Disk and insert the disk to be initialized. Execute INIT and enter the drive (unit) and select code numbers as requested. The routine takes about four minutes. If six or less defective tracks are found, the disk is usable. If more tracks are bad, the disk is rejected.

Running the Test Programs

To load the disk test programs, insert the system test cartridge and press **REWIND**. Then execute —

```
LOAD BIN 1
```

The tests assume select code 8 and drive number 0. To change the select code or drive number, use the UNIT statement, which is automatically loaded with the test program. For example to specify unit 1 on select code 9, execute —

```
UNIT 1,9
```

To run the checkread test, use the syntax — CKRD n,s,e

n = the number of test cycles. If n = 0 the test will run continuously. The cycle number is displayed after each pass.

s = starting track.

e = ending track.

Entering non-existent tracks or entering an ending track number less than the starting track number will result in an error.

The test is non-destructive. All parameters are optional (e.g., CKRD = checkread the entire disk, CKRD 1,3 = check track 3 once). CKRD PASSED is printed when the test passes.

To run the pattern test, use the syntax — PTRNTST n,s,e

This test is destructive. All parameters are optional. It will run only on a disk with no files in use. If the test is attempted on a disk containing data, an error message is printed. If a system area is tested, zeros are written in the area and a message is printed that information has been destroyed. The five octal patterns used are —

<div align="center">

143306

066154

155555

133333

000000

</div>

If a compare fail occurs during the pattern test, a compare fail message is printed listing the track, record and the failing pattern. PTRNTST PASSED is printed when the test passes.

An error message listing the track, record and type of error is printed for each read or write error during CKRD or PTRNTST. There are no rereads or rewrites if an error occurs. PTRNTST reads with a tight margin, CKRD does not. Refer to the disk errors listed next.

The routines on the Utility Routines Disk may be helpful in recovering from an error, as described at the back of the 9831A Disk Operating & Programming Manual.

9831A Disk Hardware Errors

78	I/O interrupt: for example, an interface card is plugged in while power is switched on.
79	All disk drives not switched on.
80	Disk drive door open.
81	Disk not installed or specified drive number not set.
82	Write-protected disk.
83	Disk drive record-header error.
84	Disk track not found.
85	Disk data checkword error.
86	Disk drive hardware failure. Press RESET to regain system control.
87	Verify data error: occurs during auto-verify routine. Try to reprint the data.

9831A Disk Software Errors

88	Miscellaneous disk ROM syntax error: for example, storing an incorrect IF END# statement.
89	Incorrect disk drive number or select code. Also, incorrect record pointer or word pointer.
90	Incorrect disk file name or file not found.
91	Available disk file space exceeded; also directory or availability table is full.
92	File name already exists on drive.
93	EOF (end of file) mark reached or physical end of file encountered.
94	Disk file format error: for example, a multirecord string not intact.
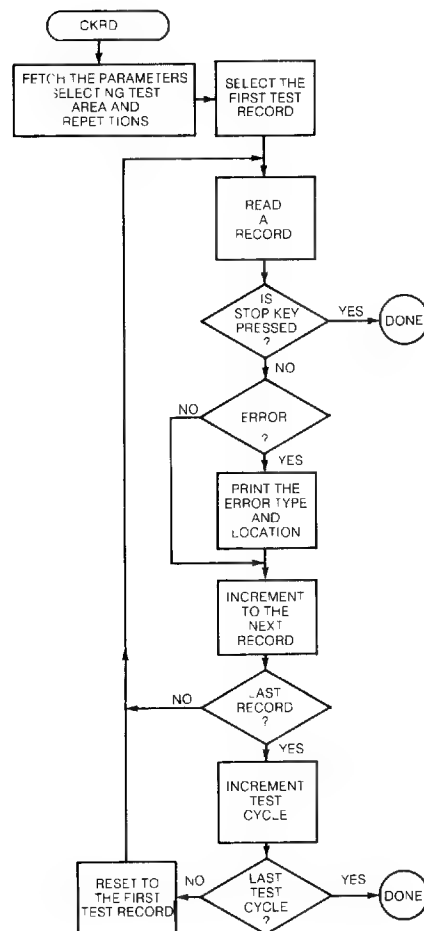
Checkread Test Flowchart

```
        ┌──────────────┐
        │   PTRN TST   │
        └──────┬───────┘
               │
        ┌──────▼───────┐
        │FETCH PARAMETERS│
        │SELECTING TEST │
        │   AREA AND    │
        │ REPETITIONS   │
        └──────┬───────┘
               │
        ┌──────▼───────┐
        │  READ EACH    │
        │RECORD OF THE  │
        │MAIN DIRECTORY │
        │TO ENSURE THAT │
        │NO USER FILES  │
        │ARE ON DISK    │
        └──────┬───────┘
```

Pattern Test Flowchart

NOTE: THIS TEST USES
OCTAL PATTERNS

143306
177777
155555
133333
000000
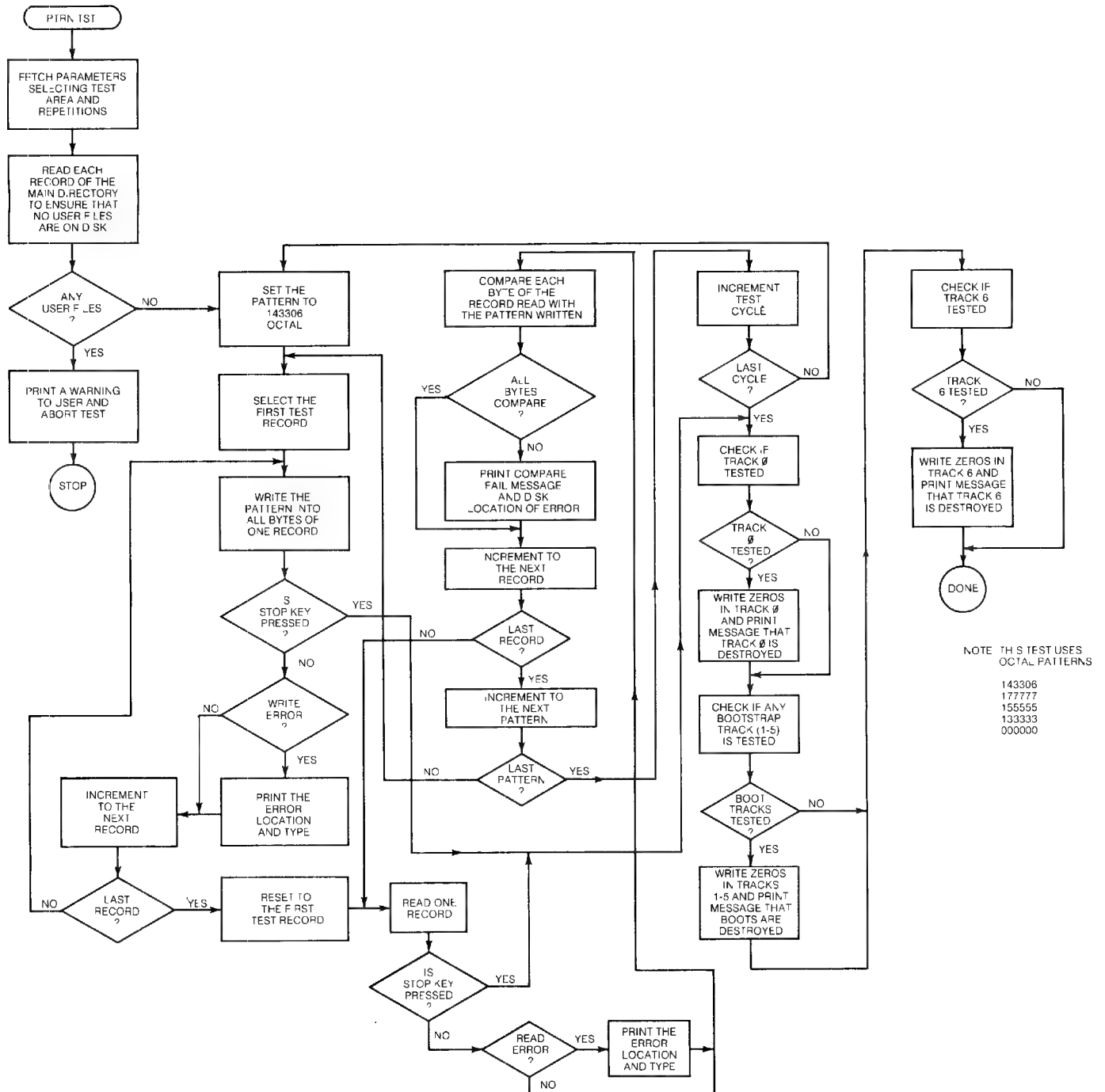
Chapter 6

Circuit Diagrams

This chapter has the 9885 circuit diagrams and component locator diagrams.

Schematic Notes

1. Component values are shown as follows unless otherwise noted —

- Resistance in ohms

- Capacitance in microfarads

- Inductance in millihenries

2. Circuit ground is denoted by ⇓
   Frame ground is denoted by ⊥ and is used for terminals which are permanently connected within approximately 0.1 ohm of earth ground.

3. Wire color is denoted by xxx. Wire color is the same as resistor color code: The first number indicates the base color, second number indicates the wider strip, and the third color indicates the narrower strip (e.g., 924 = white, red, yellow).

0	= Black	5	= Green
1	= Brown	6	= Blue
2	= Red	7	= Violet
3	= Orange	8	= Grey
4	= Yellow	9	= White

4. A bar above each line name indicates that the signal goes low (<0.7V) when pulsed true (logic 1). All other lines go high (>2.4V) when pulsed true.

9885 Line Definitions

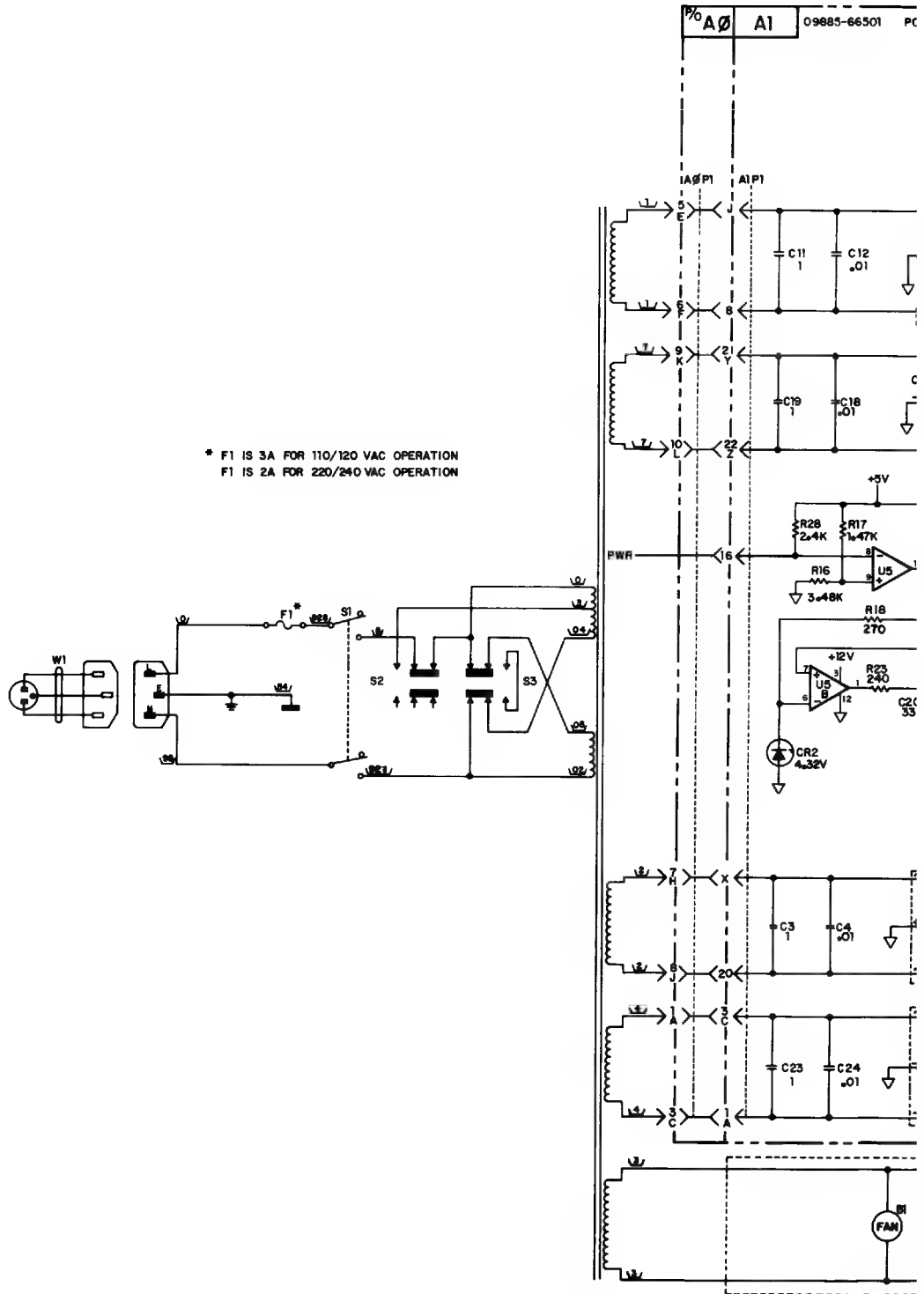| Mnemonic	Definition	Remarks
AMDT	Address Mark Detect	Output by A4 whenever an address mark is read
AMGN	Address Mark Generate	Generated by A2 when address mark s needed
BFEN	Buffer Enable	Loads the A2 read buffer (when high) with the contents of the shift register.
BYTE	Byte Sync	High when 8 bits have been loaded into the A2 shift register
CRCL	CRC Latch (DC3)	High indicates checkword error.
CTL0	Extended Contro Line	Control line used by interface when addressing the A3 assembly
DC0 DC6	Direct Control Lines	Used by nanoprocessor as input, output or flag nes.
DECD	Decode Enab e	Set high by A2 assembly whenever the A4 assembly must decode data on a read.
DIO0 – DIO15	16-bit I/O Data Bus	16-bit bidirectional I/O Bus.
D0–D7	Internal 8-b t Data Bus	8-bit bid rectional data/instruction bus for the nanoprocessor.
DOPN	Door Open	Low when disk door is open.
DRCT	Direction	Head moves toward track 0 when high and step line is pulsed
DRDY	Drive Ready	Low when drive is selected and ready for access.
DS0–DS3	Device Select Lines	Used by nanoprocessor to select nternal input or output dev ces.
EIR	External Interrupt Request (Abort DMA Transfer from Calcu ator)	Used only to abort a Direct Memory Access operation
ENCD	Encode Enable	Set high by A2 when A4 must encode data for a write.
FLAG	Byte Transfer Flag (DCU)	High when A2 shift register has shifted a byte in or out.
HDDW	Head Down (loaded)	Set low by A5 when the head is loaded.
HDLD	Head Load	Set high by A3 when head should be loaded
ICRC	CRC Input Select	When low, data s input to the checkword register for checkword generation
INDX	Index	Low once per revolut on of the disk when index nole is detected by index detector.
MTST	Marginal Transition	High when a margina transition has occurred.
OCRC	Output CRC	Low when a checkword is to be sent from checkword register to the A4 assembly.
PA0–PA10	Program Address Lines	Used by nanoprocessor to select next program address.
PCTL	Peripheral Control	Set low by calculator to indicate new data ready for write or data can be accepted for read.
PFLG	Peripheral Flag	Used with PCTL to provide handshake.
PRESET	Preset line from the calculator used to init alize the controller	Set ow by ca culator to initialize controller.
PSTS	Peripheral Status	Low if 9885 hardware not functioning properly
PVAL	Power Valid from Power Supply	Set high by A1 whenever power is applied.
PWR	Power applied to drive	Set high by A5 when power is applied
RCRC	CRC Reset	A low resets the checkword register to all zeros.
RDAT	Read Data	Serial data sent from the A4 assembly to the A2 assembly.
RTRN	Read Transition	Clock and data pulses read from the disk.
SC lines	Select Code Lines	Lines decoded from the DS0 – DS3 lines.
	SC4 = enable read buffer	
	SC5 = enable write buffer	
SEL0	Drive Select Lines	Determines the drive number. Set by the drive number sw tch on rear panel
SEL1		
SHFT	Shift/Load Select	Sent to A2 shift register when shifting data in or out.
STEP	Step (carriage)	A change from low to nigh rotates stepper motor one step.
STLT	Se f test light	High lights the self test light.
STST	START self test	H gh when self test switch is pushed
STM	START Memory	Sends next ROM instruction to nanoprocessor when low.
TRK 0	Track 0	Low when head is at track 0.
UNT0	Unit (drive number) Lines	Used by A3 assembly to select which drive wi l be addressed for disk operations.
UNT1		
WDAT	Write Data	Serial data output from the A2 sh ft register to the A4 assemb y
WPRO	Write Protect	Low when a write protected disk is inserted.
WREN	Write Enable	High when a write operation is to be done
WTRN	Write Transition	Data and clock pulses from the A4 assembly to be written on the disk

COMPONENT   SIDE

A0

-hp- Part No. 09885-66500   Rev A

A0   09885-66500 MOTHER BOARD

XA3B

XA2

XA1

XA3A

P1

P2

XA3A

P1
A,1   AC FOR 24V
B,2   AC FOR 24V
C,3   AC FOR 12V
D,4   AC FOR 12V
E,5   AC FOR 12V
F,6   AC FOR 12V
H,7   AC FOR -5V
J,8   AC FOR -5V
K,9   AC FOR 5V
LJ,0 AC FOR 5V

+5V

+24V   +12V   AC   SIGND

GND   ENCD   AMGN   WDAT

GND   RTRN   CKB

SIGND   +24V

9885-D-51031

P2

CHASSIS
GND

A0 09885-66500 MOTHER BOARD

XA1

XA3A

XA2

XA3B

XA4

J1

P1

P2

9885-D-51031

CHASSIS GND

P2

SIDE

Rev A

COMPONENT SIDE

A1

-hp- Part No. 09885-66501   Rev B

* F1 IS 3A FOR 110/120 VAC OPERATION
  F1 IS 2A FOR 220/240 VAC OPERATION

COMPONENT   SIDE

A1

-hp- Part No. 09885-66501   Rev B

* F1 IS 3A FOR 110/120 VAC OPERATION
  F1 IS 2A FOR 220/240 VAC OPERATION

A1 Power Supply Assembly Schematic Diagram
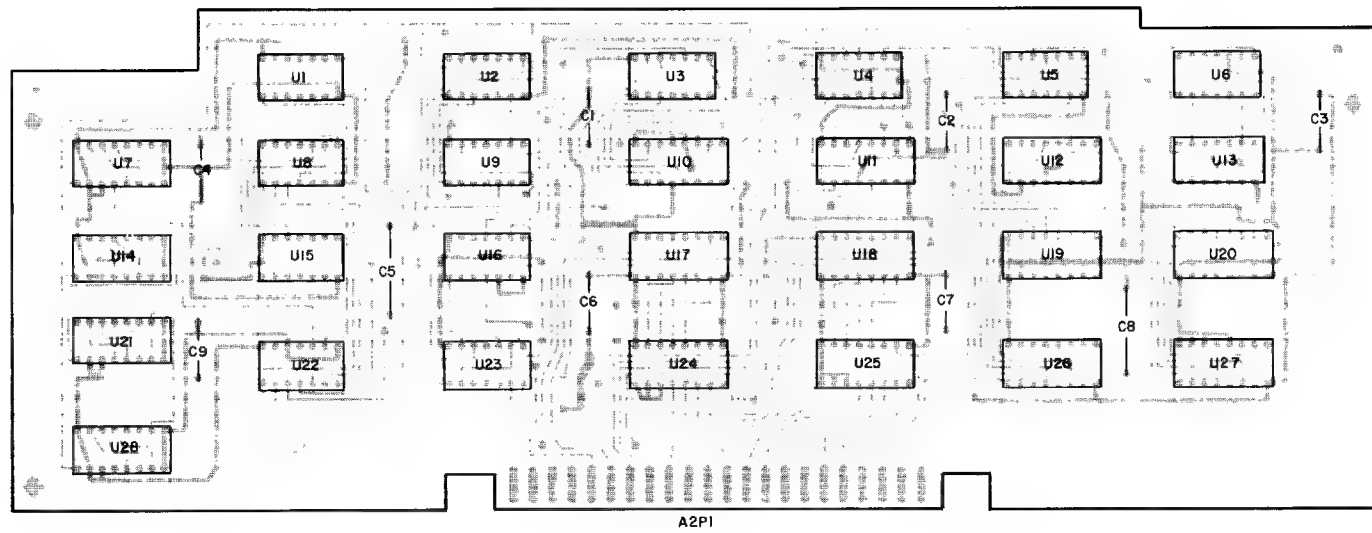
COMPONENT SIDE

A2

-hp- Part No. 09885-66502   Rev B

A2   09885-66502 BIT/BYTE CONVERTER
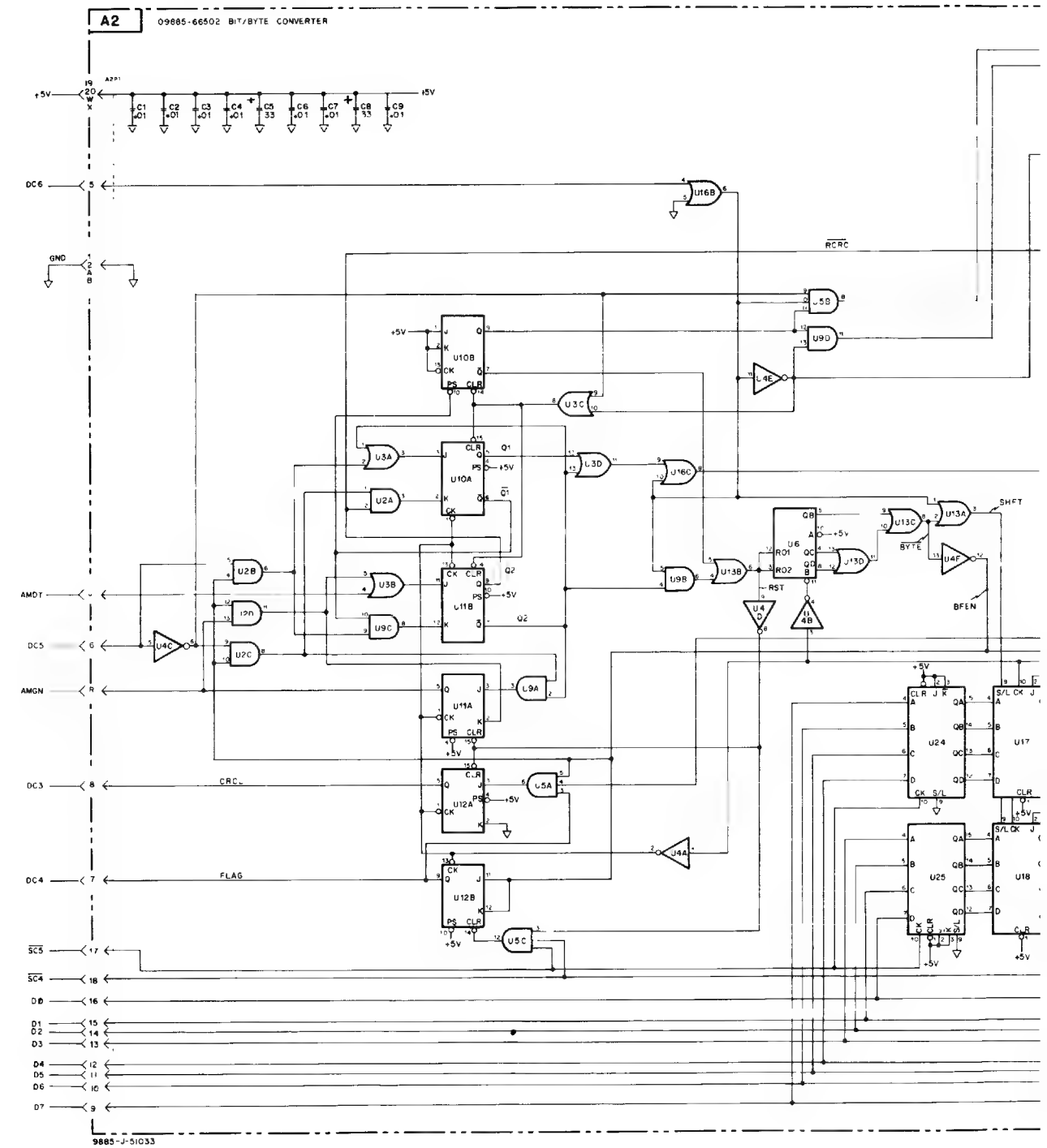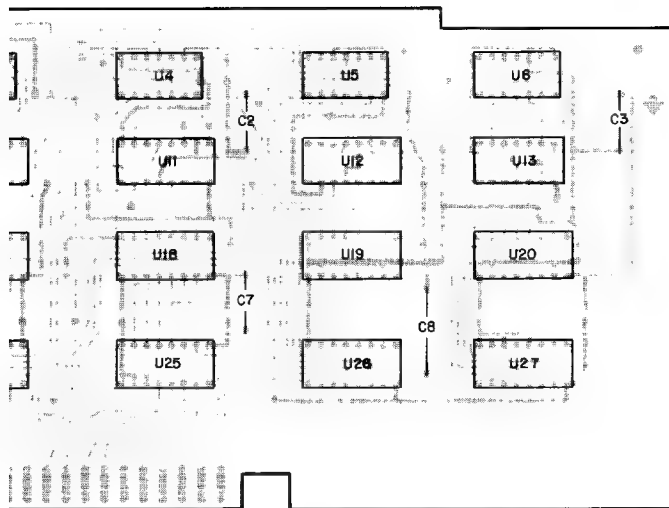
NT SIDE

2

5-66502 Rev B
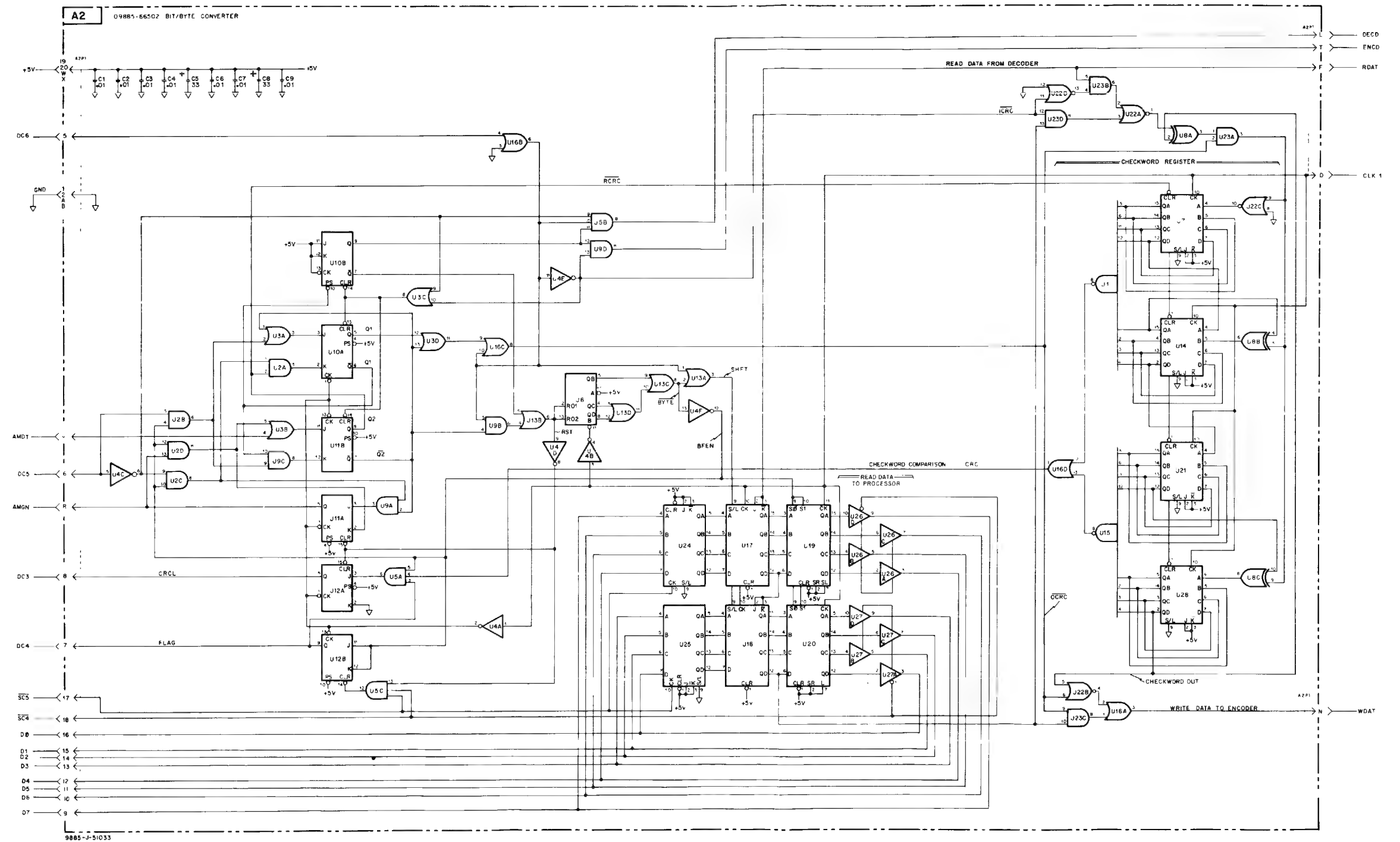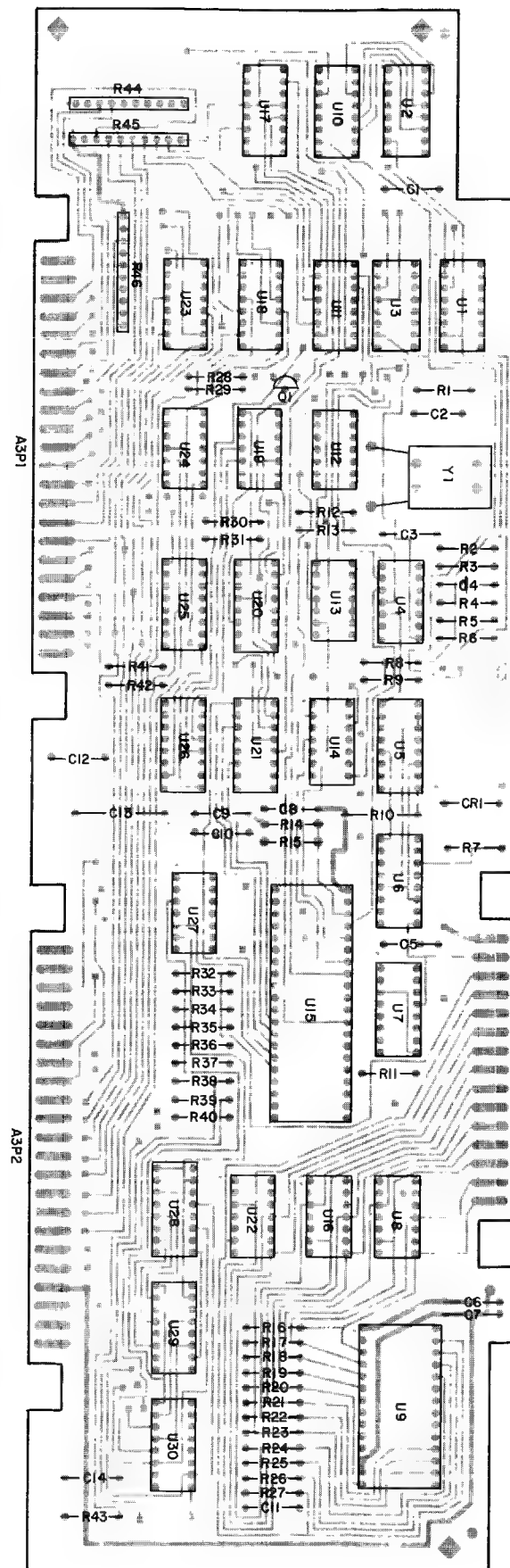
COMPONENT SIDE

A3

-hp- Part No. 09885-66503   Rev B
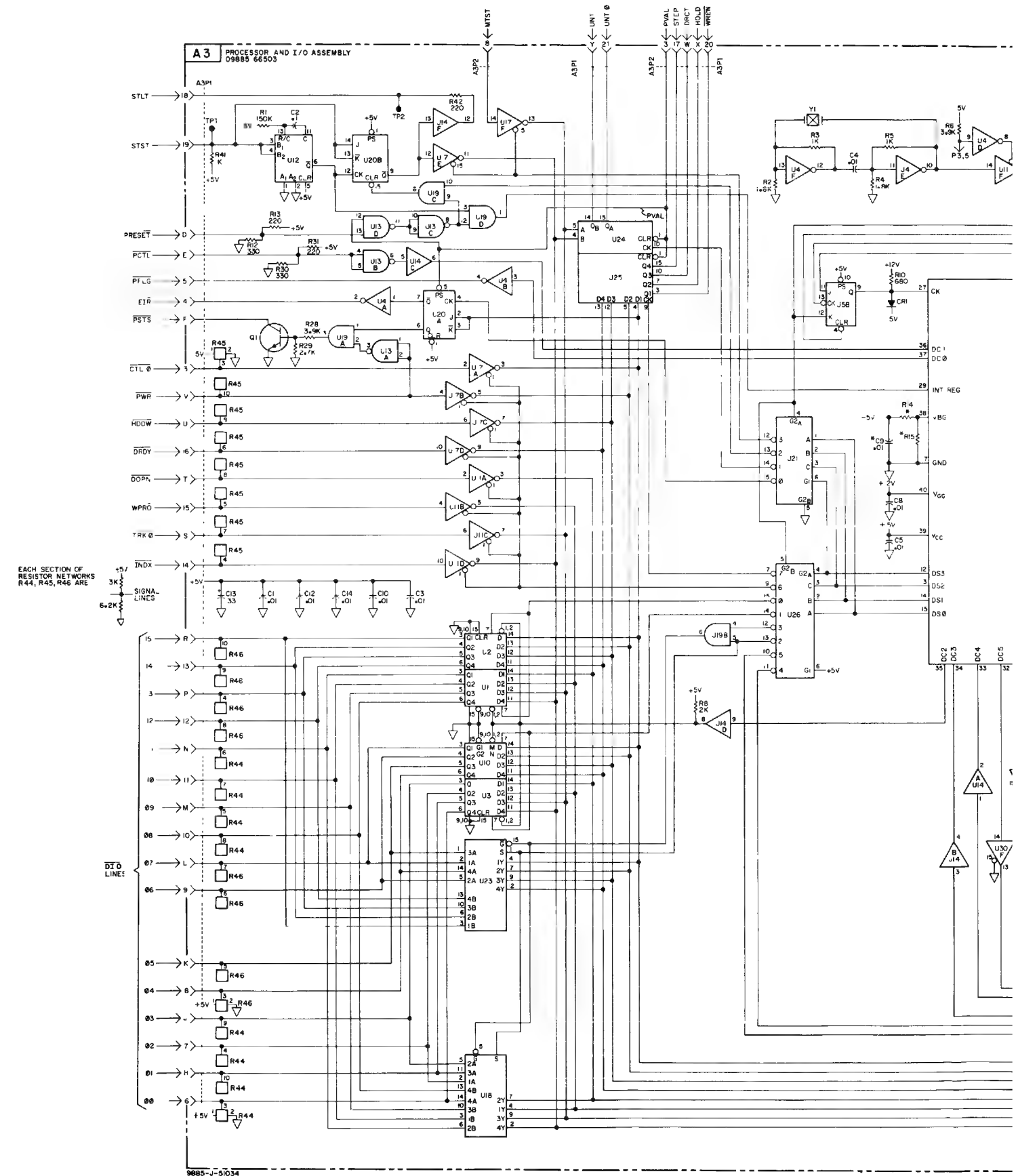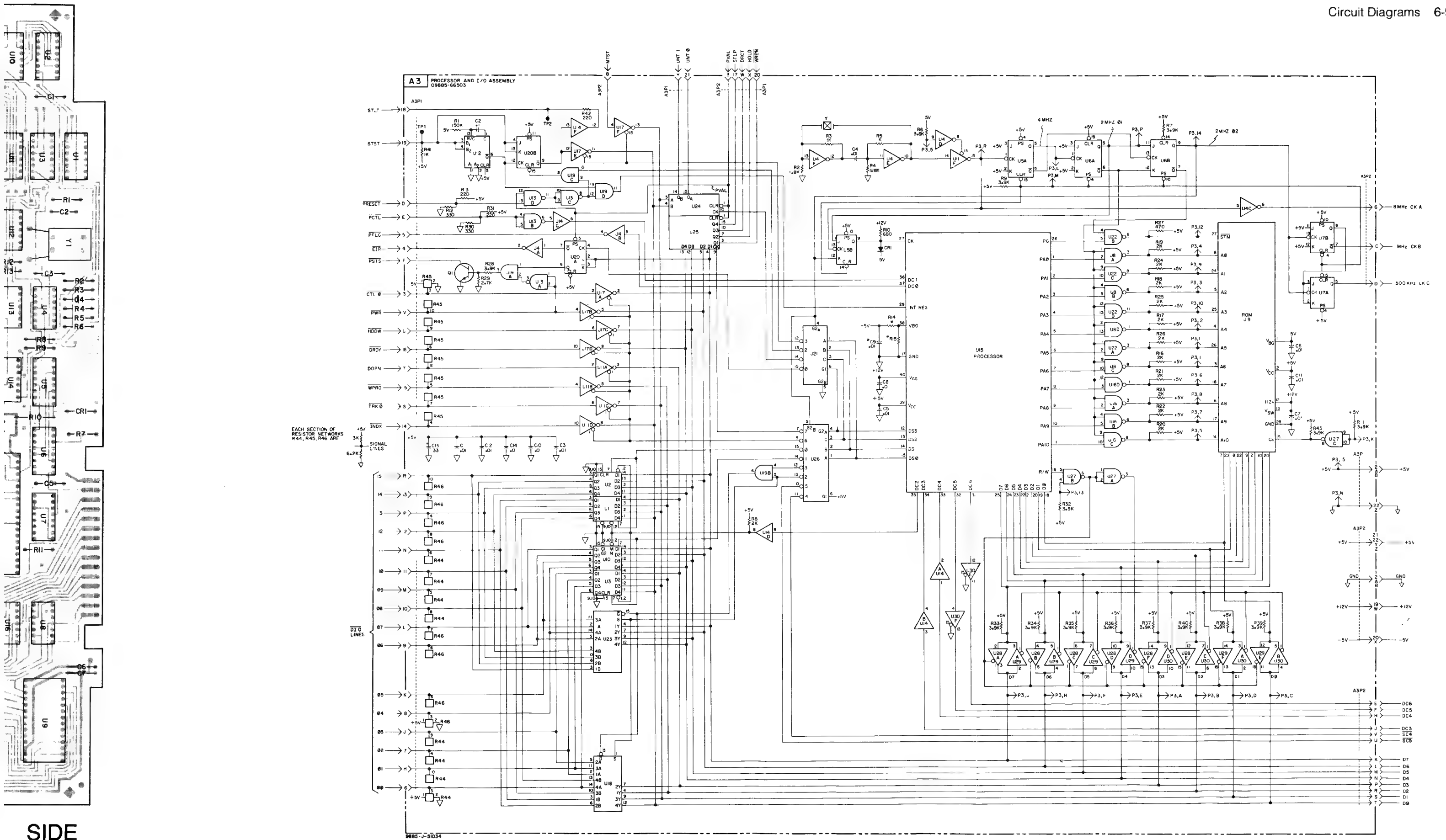
SIDE

A3 Processor and I/O Assembly Schematic Diagram
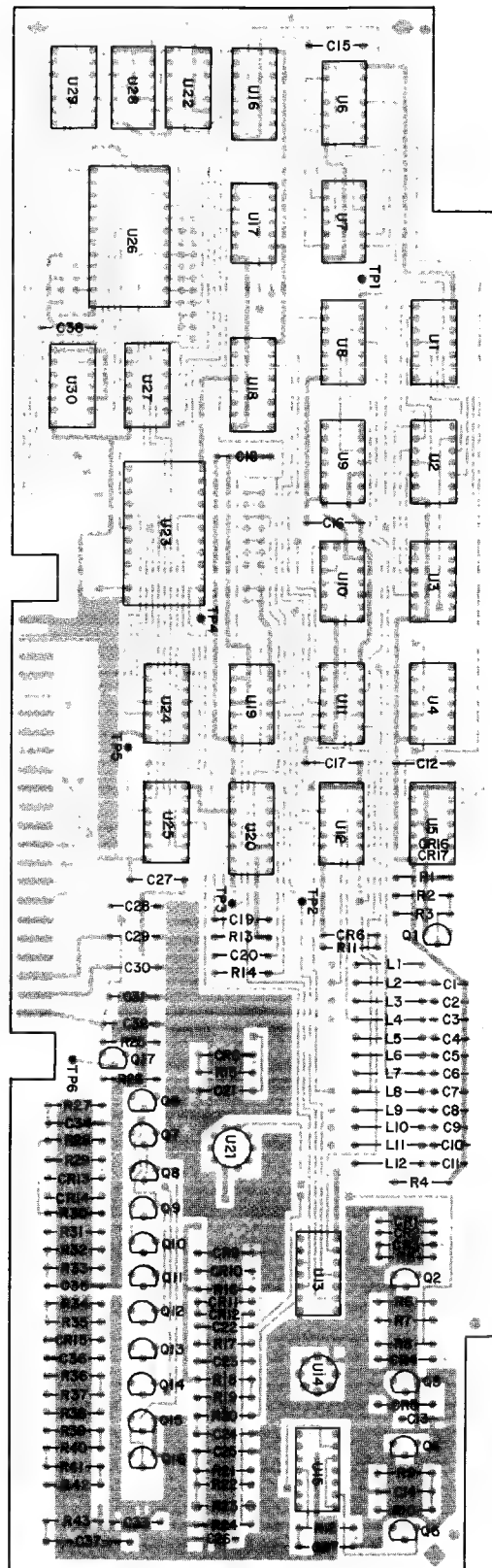
COMPONENT SIDE

A4

-hp- Part No. 09885-66504   Rev B
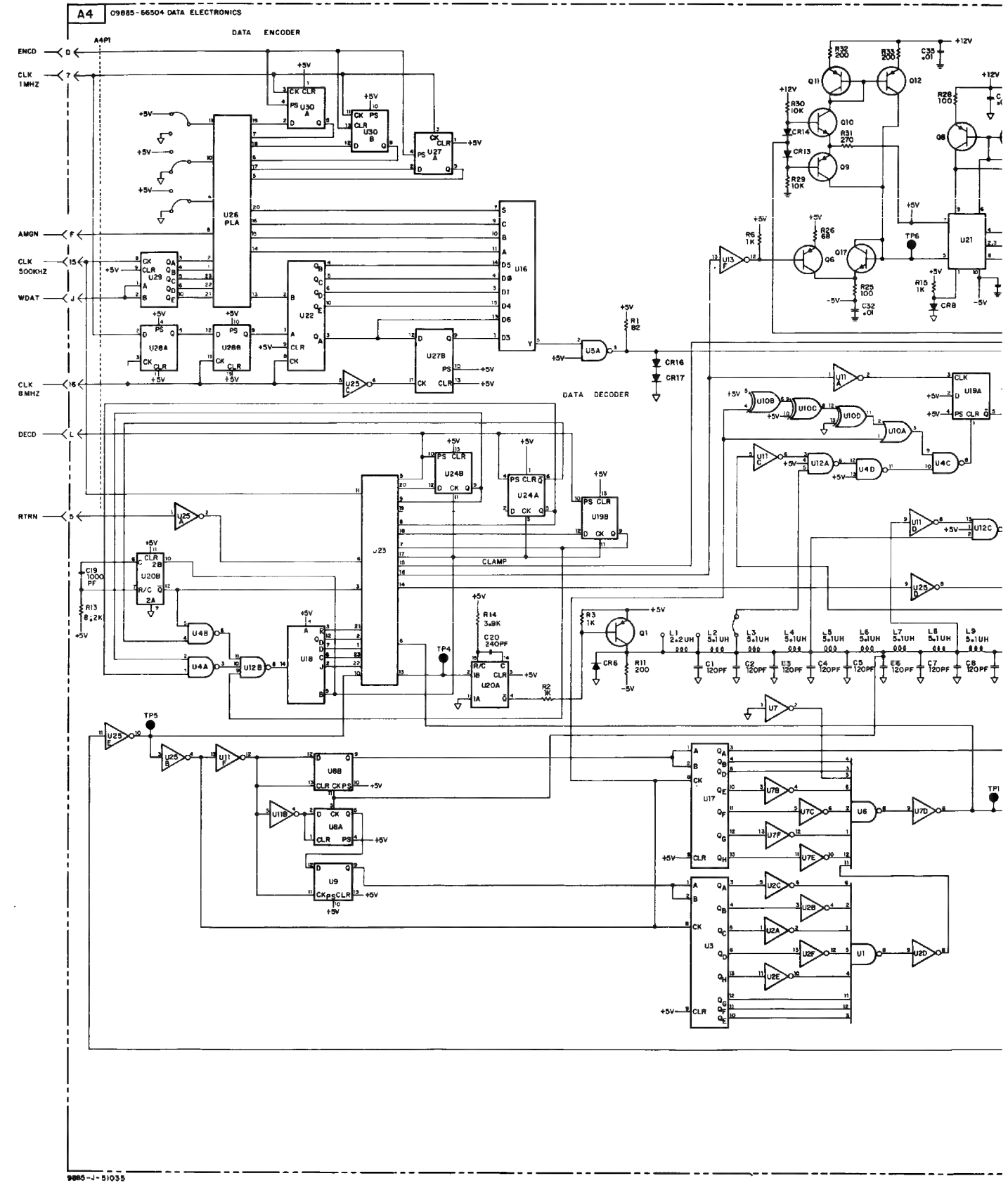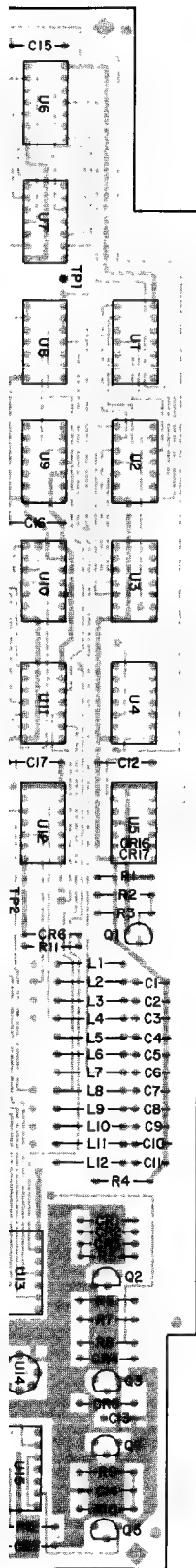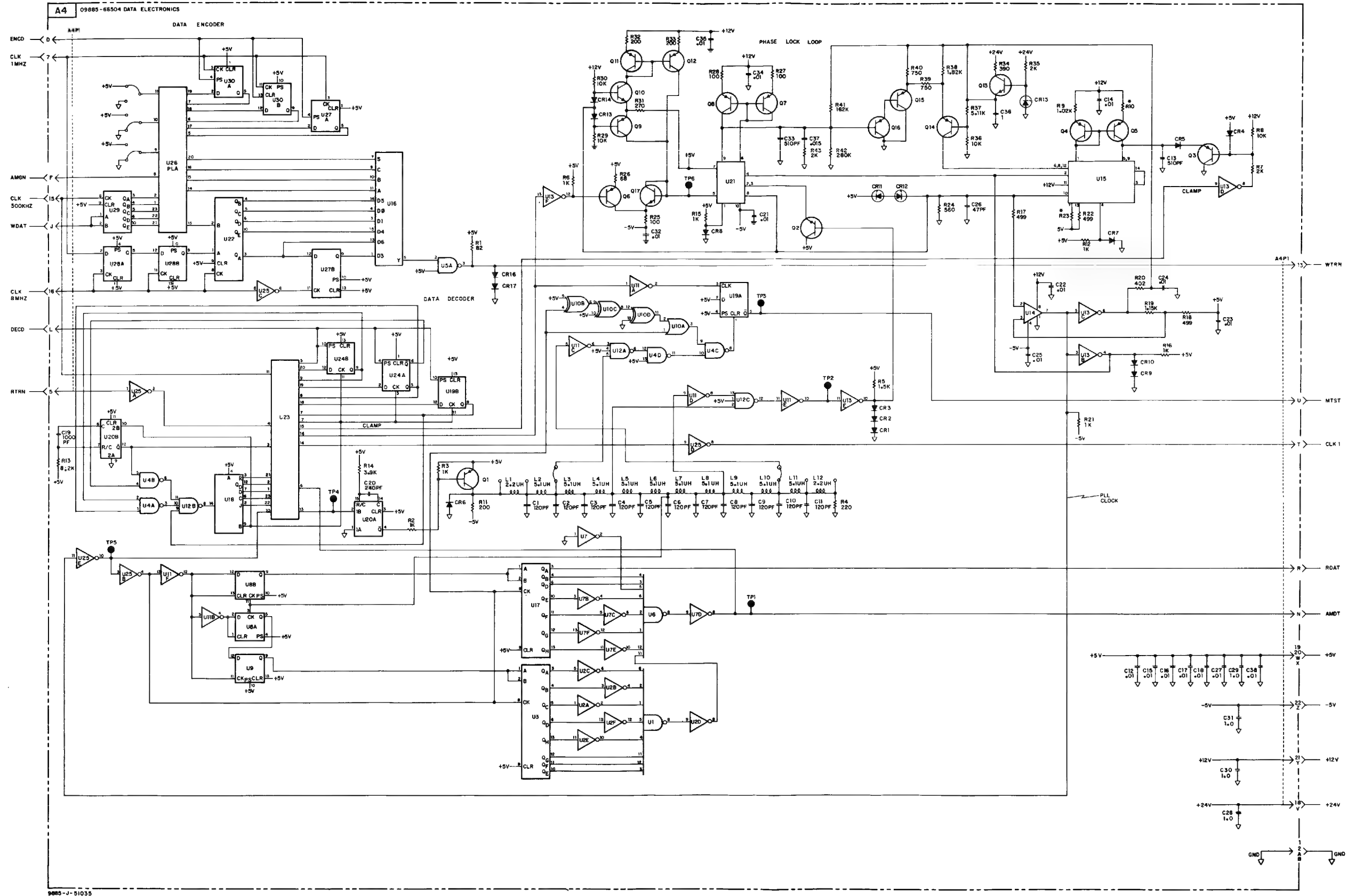
rev:9/78

A4 Data Electronics Assembly Schematic Diagram
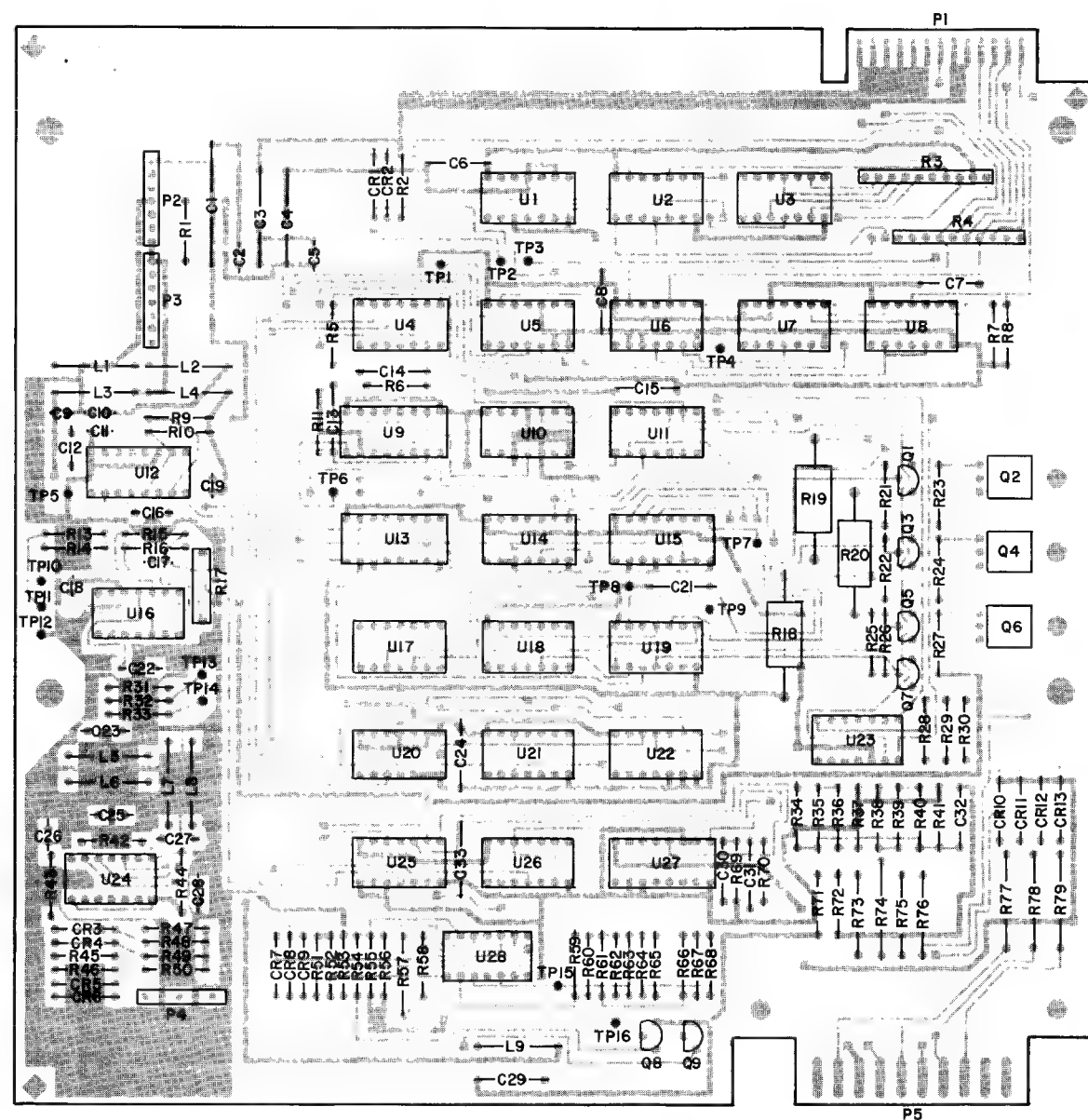
COMPONENT SIDE

A5

-hp- Part No. 09885-66505   Rev C

T SIDE

COMPONENT   SIDE

A7

-hp- Part No. 09885-66507   Rev A
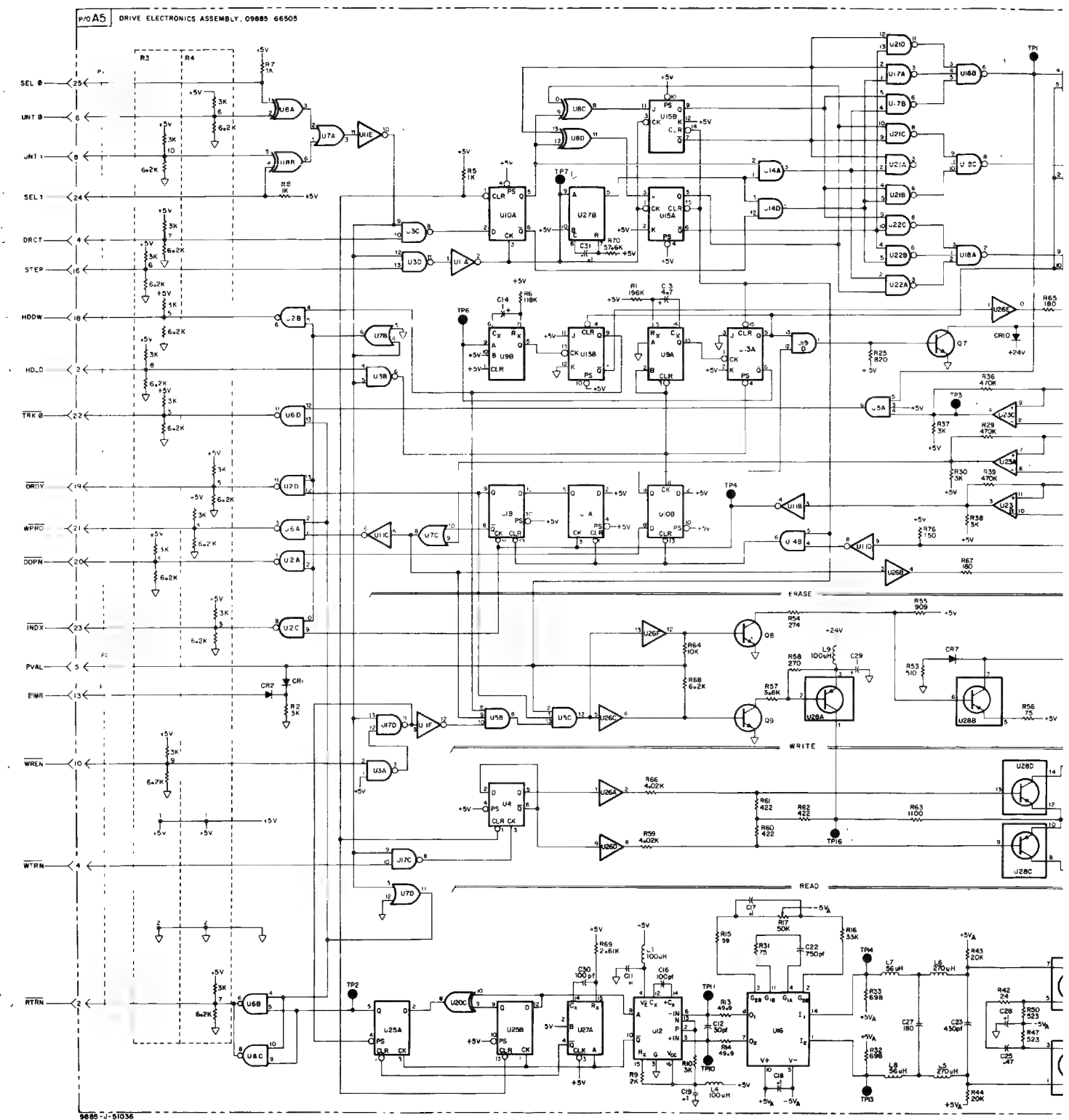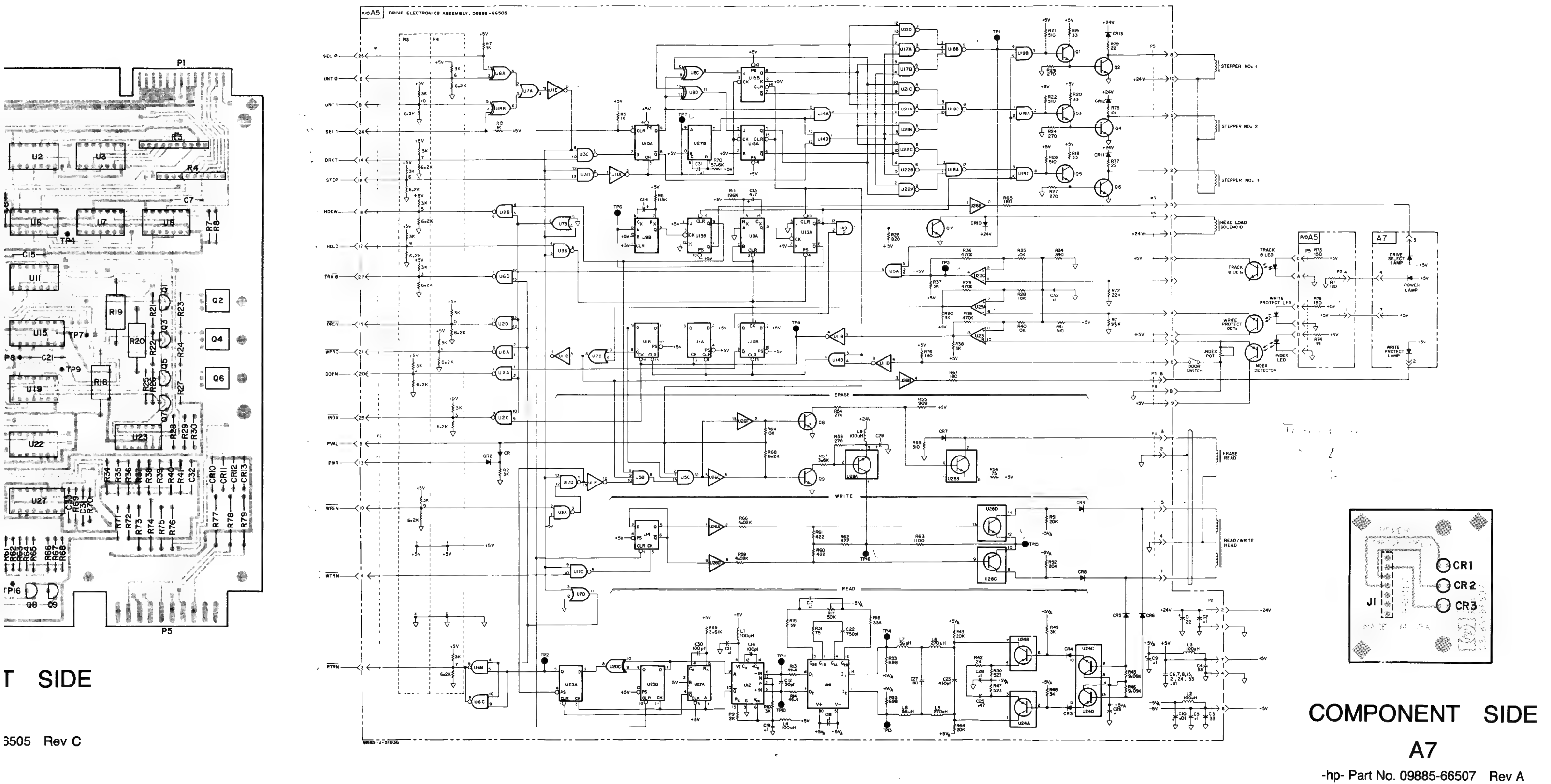
A5 Drive Electronics Assembly Schematic Diagram (includes A7)

J1 — Interface from calculator connects here. This connector is not present on the 9885S.

J2 — 9885M lower connector, 9885S top connector. Slave cable connects here.

J3 — Lower connector on 9885S, not present on 9885M.

P1 — Large ribbon cable which connects to A0.

P2 — Small ribbon cable which connects to A5.
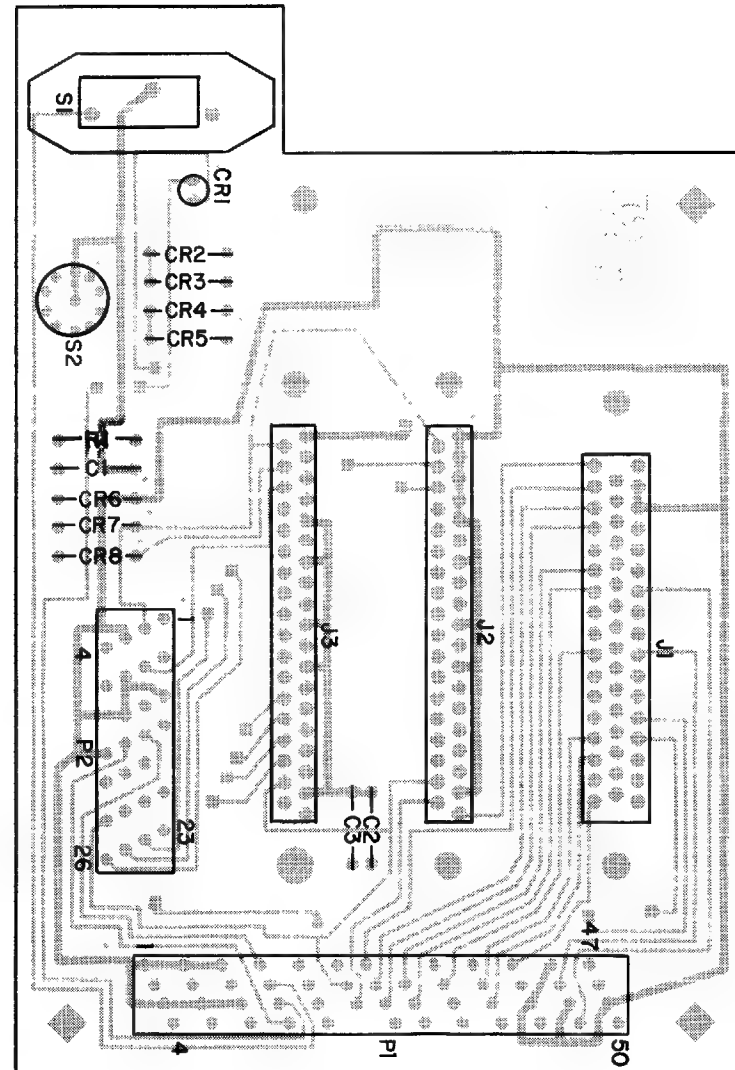
COMPONENT SIDE

A6-A8

-hp- Part No. 09885-66506   Rev A
-hp- Part No. 09885-66508   Rev B

A6/A8 Interconnect Assembly Schematic Diagram
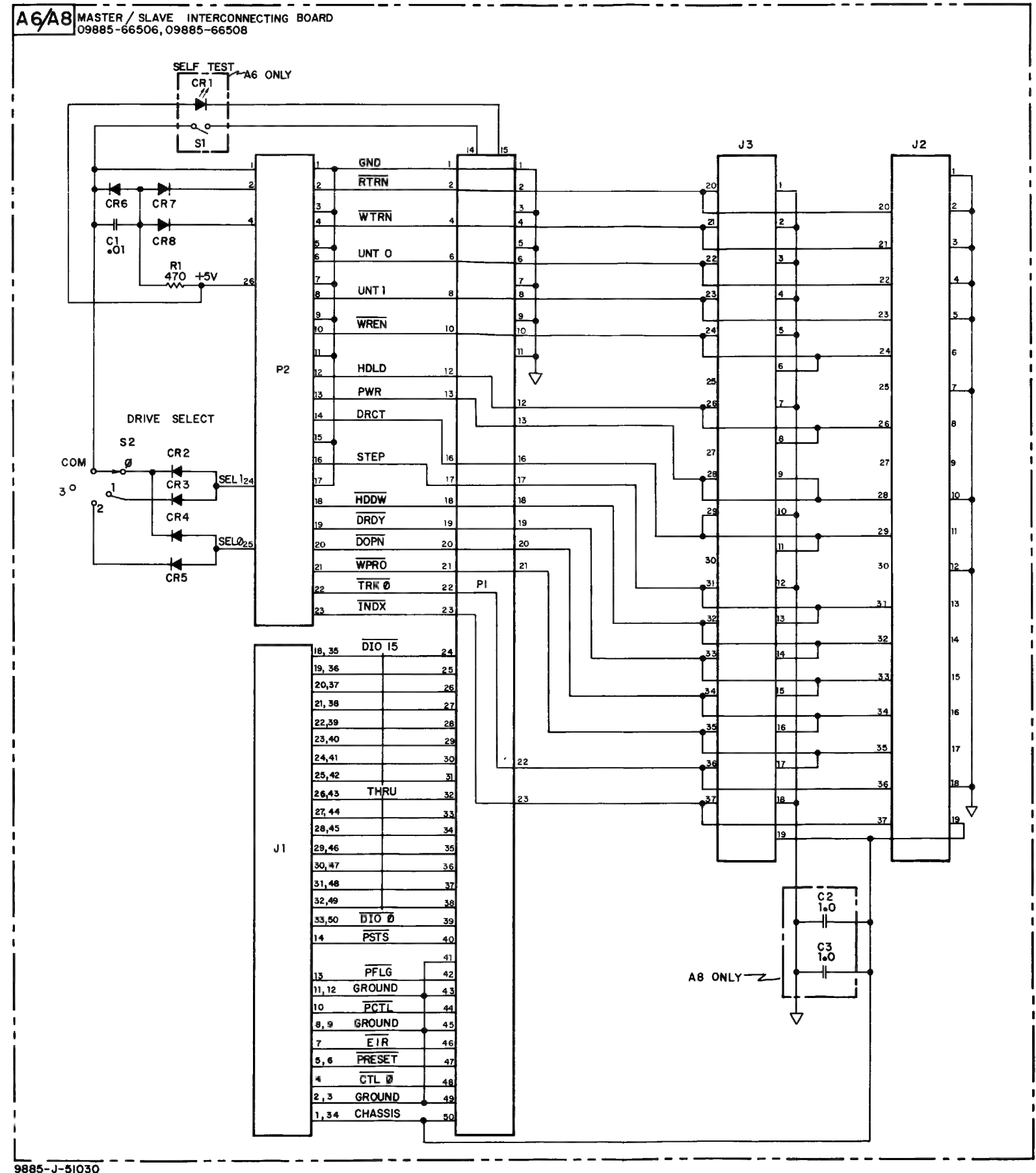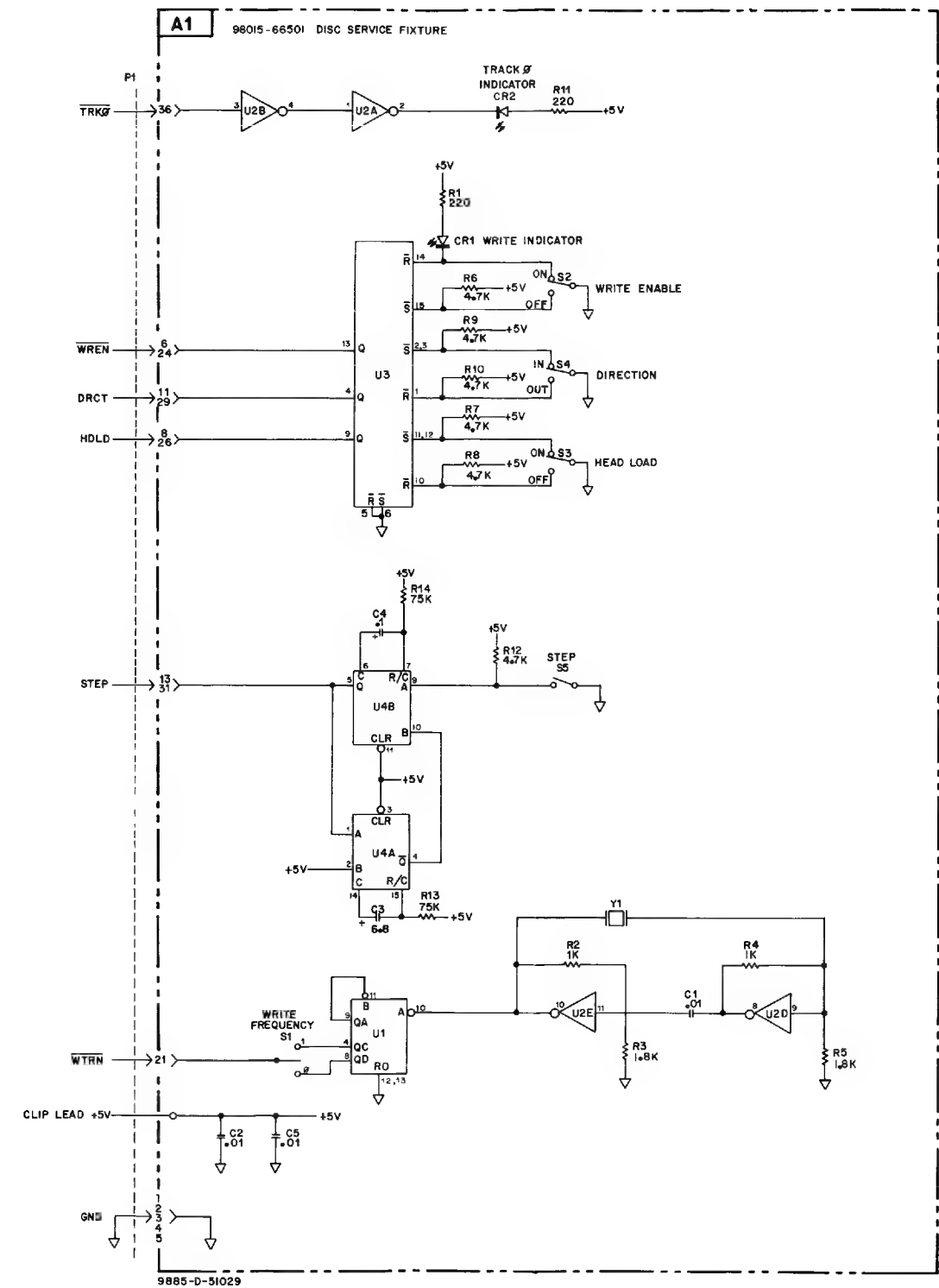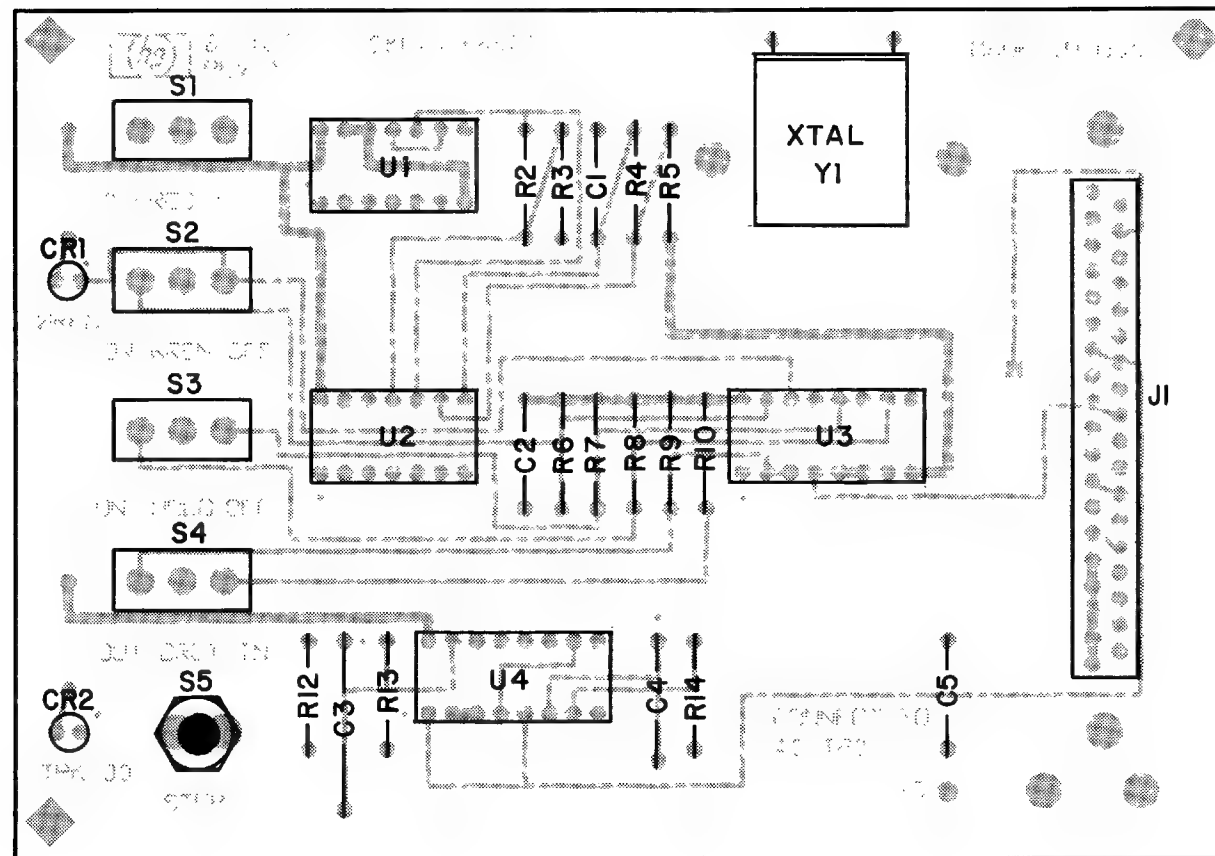
Disk Service Fixture Schematic Diagram

Chapter **7**

Replaceable Parts

Introduction

This chapter provides ordering information for the 9885 electrical and mechanical parts.

The electrical components on a particular printed circuit are listed in the order of their component designators. The mechanical drive parts are listed with reference numbers. These reference numbers correspond to the numbered parts illustrations. The numbers in the quantity column indicate the total quantity of a part used on a particular assembly. The quantity is given only the first time the part number is listed.

All manufacturer's part numbers listed for the drive mechanical parts are numbers of Shugart Associates, Sunnyvale, California, 94086.

Replaceable Parts

REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION
A∅	09885-66500		**Motherboard Assembly**
C1	0160-0128	1	C-F: 2.2UF 25V
	1251-1887	5	Connector – PC 44 pin
	1251-4498	1	Connector – 7 pin
A1	09885-66501		**Power Supply Assembly**
C1	0150-0014	1	C-F: 5000PF 20%
C2	0180-0578	1	C-F: 750UF 40V
C3	0160-0127	4	C-F: 1UF 25V
C4	0160-3847	3	C-F: .01UF 25V
C5,C6	0160-3622	4	C-F: .1UF 50V
C7	0160-2605	1	C-F: .02UF 25V
C8	0160-3847		C-F: .01UF 25V
C9	0160-0576	10	C-F: 1UF 50V
C10	0160-3622		C-F: .1UF 50V
C11	0160-3508	1	C-F: 1UF
C12	0160-3879	2	C-F: .01UF 100V
C13	0160-0174	1	C-F: .47UF 25V
C14	0160-0127		C-F: 1UF 25V
C15	0160-0583	1	C-F: 6000UF 30V
C16	0180-2666	2	C-F: 1000UF 60V
C17	0180-0237	1	C-F: 500UF 25V
C18	0160-3847		C-F: .01UF 25V
C19	0160-0127		C-F: 1UF 25V
C20	0180-0229	1	C-F: 33UF 10V
C21	0160-3622		C-F: .1UF 50V
C22	0180-0348	1	C-F: 1.2UF 35V
C23	0160-4005	1	C-F: 1UF 100V
C24	0160-3879		C-F: .01UF 100V
C25	0180-2666		C-F: 1000UF 60V
C26	0160-0576		C-F: .1UF
CR1	1902-0654	1	DIO: ZNR 33.2V
CR2	1902-3073	1	DIO: ZNR 4.32V
CR3,CR4	1901-0040	3	DIO: SI .05A 30V
CR5 thru CR8	1901-0662	4	DIO: Power Rectifier
CR9	1902-3002	1	DIO: ZNR 2.37V
CR10	1901-0040		DIO: SI .05A 30V
CR11,CR12	1901-0364	2	Diode Assembly
CR13	1901-0638	1	Diode Assembly
Q1	1854-0063	2	XSTR: 2N3055
Q2	1854-0039	2	XSTR: 2N3053
Q3	1854-0063		XSTR: 2N3055
Q4	1854-0039		XSTR: 2N3053
Q5	1854-0087	1	XSTR: SI NPN
Q6,Q7	1854-0215	2	XSTR: 2N3904
Q8	1854-0071	1	XSTR: SPS5103
R1	0698-4471	1	R-F: 7.15K 1%
R2	0757-0438	2	R-F: 5.11K 1%
R3	0683-1035	3	R-F: 10K 5%
R4	0683-5125	5	R-F: 5.1K 5%
R5	0698-3132	1	R-F: 261 1%
R6	0757-0416	1	R-F: 511 1%
R7	0683-1035		R-F: 10K 5%
R8	2100-3350	1	R-Variable 200 10%
R9	0683-1035		R-F: 10K 5%
R10	0757-0438		R-F: 5.11K 1%
R11	0698-4484	1	R-F: 19.1K 1%

Replaceable Parts (Cont.)

REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION
R12	0683-1025	1	R-F: 1K 5%
R13	0683-0395	1	R-F: 3.9 5%
R14	0811-2654	1	R-F: .18 10%
R15	0683-5125		R-F: 5.1K 5%
R16	0698-3152	1	R-F: 3.48K 5%
R17	0757-1094	1	R-F: 1.47K 1%
R18	0683-2115	1	R-F: 270 5%
R19	0698-3279		R-F: 4.99K 1%
R20	0757-0283	1	R-F: 2K 1%
R21	0683-5125		R-F: 5.1K 5%
R22	0683-4325	1	R-F: 4.3K 5%
R23	0683-2415	1	R-F: 240 5%
R24	0683-5125	1	R-F: 5.1K 5%
R25	0683-5625	1	R-F: 5.6K 5%
R26	0812-0045	1	R-F: .15 3%
R27	0683-5115	1	R-F: 510 5%
R28,R29	0683-2425	2	R-F: 2.4K 5%
R30	0683-6805	1	R-F: 68 5%
R31	0683-5105	1	R-F: 51 5%
R32	0683-2035	1	R-F: 20K 5%
R33	0686-4325	1	R-F: 4.3K 5%
U1 thru U3	1820-0196	3	IC: U5R7723393
U4	1826-0220	1	IC: LM320H
U5	1826-0174	1	IC: MC3302
U6	1820-0207	1	IC: V1A960159X
	09885-04101	1	Heat Sink Cover
	1200-0043	2	Transistor Insulators
	1205-0011	2	Transistor Heat Sink
	1400-0493	3	Cable Strap
A2	**09885-66502**	**1**	**Bit/Byte Converter Assembly**
C1 thru C4	0160-3847	7	C-F: .01UF 25V
C5	0180-0229	2	C-F: 33UF 10V
C6,C7	0160-3847		C-F: .01UF 25V
C8	0180-0229		C-F: 33UF 10V
C9	0160-3847		C-F: .01UF 25V
U1	1820-1207	2	C-F: 74LS30
U2	1820-1201	3	IC: 74LS08
U3	1820-1208	3	IC: 74LS32
U4	1820-1199	1	IC: 74LS04
U5	1820-1203	1	IC: 74LS11
U6	1820-1443	1	IC: 74LS293
U7	1820-1300	8	IC: 74LS195
U8	1820-1211	1	IC: 74LS86
U9	1820-1201		IC: 74LS08
U10 thru U12	1820-1212	3	IC: 74LS112
U13	1820-1208		IC: 74LS32
U14	1820-1300		IC: 74LS195
U15	1820-1207		IC: 74LS30
U16	1820-1208		IC: 74LS32
U17,U18	1820-1300		IC: 74LS195
U19,U20	1820-1276	2	IC: 74LS194
U21	1820-1300		IC: 74LS195
U22	1820-1144	1	IC: 74LS02
U23	1820-1201		IC: 74LS08
U24,U25	1820-1300		IC: 74LS195

Replaceable Parts (Cont.)

REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION
U26,U27	1820-1491	2	IC: 74LS367
U28	1820-1300		IC: 74LS195
A3	**09885-66503**		**Processor, I/O Assembly**
C1	0160-3847	12	C-F: .01UF 25V
C2	0150-0121	1	C-F: .1UF 50V
C3 thru C12	0160-3847		C-F: .01UF 25V
C13	0180-0229	1	C-F: 33UF 10V
C14	0160-3847		C-F: .01UF 25V
CR1	1901-0040	1	DIO: Si .05A 30V
Q1	1854-0071	1	XSTR: NPN SPS5103
R1	0683-1545	1	R-F: 150K ¼w
R2	0683-1825	2	R-F: 1.8K 5%
R3	0683-1025	3	R-F: 1K 5%
R4	0683-1825		R-F: 1.8K 5%
R5	0683-1025		R-F: 1K 5%
R6,R7	0683-3925	15	R-F: 3.9K 5%
R8	0683-2025	12	R-F: 2K 5%
R9	0683-3925		R-F: 3.9K 5%
R10	0686-6815	1	R-F: 680 5% ½w
R11	0683-3925		R-F: 3.9K 5%
R12	0683-3315	2	R-F: 330 5%
R13	0683-2215	3	R-F: 220 5%
R14			See Padding List
	0757-0418		R-F: 619 (−2.0V)
	0698-3447		R-F: 422 (−2.5V)
	0698-3447		R-F: 422 (−3.0V)
	0698-3443		R-F: 287 (−3.5V)
	0698-3440		R-F: 196 (−4.0V)
	0757-0401		R-F: 100 (−4.5V)
	0757-0346		R-F: 10 (−5.0V)
R15			See Padding List
	0698-3447		R-F: 422 (−2.0V)
	0698-3447		R-F: 422 (−2.5V)
	0757-0418		R-F: 619 (−3.0V)
	0757-0419		R-F: 681 (−3.5V)
	0757-0421		R-F: 825 (−4.0V)
	0757-0422		R-F: 909 (−4.5V)
	0757-0280		R-F: 1000 (−5.0V)
R16 thru R26	0683-2025		R-F: 2K 5%
R27	0683-4715	1	R-F: 470 5%
R28	0683-3925		R-F: 3.9K 5%
R29	0683-2725	1	R-F: 2.7K 5%
R30	0683-3315		R-F: 330 5%
R31	0683-2215		R-F: 220 5%
R32 thru R40	0683-3925		R-F: 3.9K 5%
R41	0683-1025		R-F: 1K 5%
R42	0683-2215		R-F: 220 5%
R43	0683-3925		R-F: 3.9K 5%
R44 thru R46	1810-0136	3	R-Network 216C
U1 thru U3	1820-0574	4	IC: DM8551N
U4	1820-0683	1	IC: 74S04N
U5,U6	1820-0269	2	IC: 74S112N
U7	1820-1212	1	IC: 74LS112N

Replaceable Parts (Cont.)

REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION
U8	1820-0269	3	IC: 7403N
U9	1818-2643	1	IC: ROM
U10	1820-0574		IC: DM8551N
U11	1820-1492	2	IC: 74LS368N
U12	1820-1422	1	IC: 74LS122
U13	1820-1425	1	IC: 74LS132
U14	1820-0668	1	IC: 7407
U15	1820-1692	1	IC: Nanoprocessor
U16	1820-0269		IC: 7403N
U17	1820-1492		IC: 74LS368N
U18	1820-1438	2	IC: 74LS257
U19	1820-1201	1	IC: 74LS08
U20	1820-1282	1	IC: 74LS109
U21	1820-1216	2	IC: 74LS138
U22	1820-0269		IC: 7403N
U23	1820-1438		IC: 74LS257
U24	1820-1300	1	IC: 74LS195N
U25	1820-1195	1	IC: 74LS175
U26	1820-1216		IC: 74LS138
U27	1820-1197	1	IC: 74LS00N
U28 thru U30	1820-1491	3	IC: 74LS367N
Y1	0410-0443	1	Crystal: 8MHz
	1200-0552	1	Socket: IC-40 pm
	1200-0553	1	Socket: IC
	1200-0770	1	Socket: Crystal
	0403-0189		PC Extractor, Black
	4040-0751		PC Extractor, Orange
A4	**09885-66504**		**Data Electronics Assembly**
C1 thru C11	0160-2205	11	C-F: 120PF 300V
C12	0160-3847	16	C-F: .01UF 25V
C13	0160-0362	2	C-F: 510PF 300V
C14 thru C18	0160-3847		C-F: .01UF 25V
C19	0160-0938	1	C-F: 1000PF 100V
C20	0140-0199	1	C-F: 240PF 300V
C21 thru C25	0160-3847		C-F: .01UF 25V
C26	0160-2307	1	C-F: 47PF 300V
C27	0160-3847		C-F: .01UF 25V
C28 thru 31	0160-0127	5	C-F: 1UF 25V
C32	0160-3847		C-F: .01UF 25V
C33	0160-0362		C-F: 510PF 300V
C34,C35	0160-3847		C-F: .01UF 25V
C36	0160-0127		C-F: 1UF 25V
C37	0160-0194	1	C-F: .015UF 200V
C38	0160-3847		C-F: .01UF 25V
CR1 thru CR10	1901-0040	12	DIO: SI .05A 30V
CR11,CR12	1902-3002	2	DIO: ZNR 2.37V
CR13,CR14	1901-0040		DIO: SI .05A 30V
CR15	1902-3182	1	DIO: ZNR 12.1V
CR16	1901-0050	1	DIO:
CR17	5082-4584	1	DIO: LED
L1	9140-0098	2	L-F: 2.2UH
L2 thru L11	9100-3559	10	L-F: 5.1UH
L12	9140-0098		L-F: 2.2UH
Q1	1853-0089	13	XSTR: 2N4917
Q2	1854-0092	4	XSTR: 2N3563

Replaceable Parts (Cont.)

REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION
Q3 thru Q9	1853-0089		XSTR: 2N4917
Q10	1854-0092		XSTR: 2N3563
Q11,Q12	1853-0089		XSTR: 2N4917
Q13	1854-0092		XSTR: 2N3563
Q14 thru Q16	1853-0089		XSTR: 2N4917
Q17	1854-0092		XSTR: 2N3563
R1	0683-8205	1	R-F: 82 5%
R2,R3	0683-1025	7	R-F: 1K 5%
R4	0683-2015	4	R-F: 200 5%
R5	0683-1525	2	R-F: 1.5K 5%
R6	0683-1025		R-F: 1K 5%
R7	0683-2025	3	R-F: 2K 5%
R8	0683-1035	4	R-F: 10K 5%
R9	0698-4195	1	R-F: 1.02K 1%
R10			See Padding List
	0698-4422		1270 1%
	0757-0426		1300 1%
	0757-0317		1330 1%
	0698-4423		1370 1%
	0698-4424		1400 1%
	0698-3225		1430 1%
	0757-1094		1470 1%
	0757-0427		1500 1%
	0698-4425		1540 1%
	0698-4426		1580 1%
	0757-0428		1620 1%
R11	0683-2015		R-F: 200 5%
R12	0683-1025		R-F: 1K 5%
R13	0683-8225		R-F: 8.2K 5%
R14	0683-3925	1	R-F: 3.9K 5%
R15,R16	0683-1025		R-F: 1K 5%
R17,R18	0698-4123	3	R-F: 499 1%
R19	0698-4469	1	R-F: 1.15K 1%
R20	0698-4453	1	R-F: 402 1%
R21	0683-1025		R-F: 1K 5%
R22	0698-4123		R-F: 499 1%
R23			See Padding List
	0698-3122		R-F: 412 1%
	0698-3447		R-F: 422 1%
	0757-0414		R-F: 432 1%
	0698-3488		R-F: 442 1%
	0698-3510		R-F: 453 1%
	0698-0082		R-F: 464 1%
	0757-0415		R-F: 475 1%
	0698-3178		R-F: 487 1%
	0698-4123		R-F: 499 1%
	0757-0416		R-F: 511 1%
	0698-4454		R-F: 523 1%
	0698-4455		R-F: 536 1%
	0698-4456		R-F: 549 1%
	0757-0417		R-F: 562 1%
	0698-4457		R-F: 576 1%
	0698-4458		R-F: 590 1%
	0757-0161		R-F: 604 1%
	0757-0418		R-F: 619 1%
	0698-4459		R-F: 634 1%
	0698-4460		R-F: 649 1%
	0698-3511		R-F: 665 1%

rev:9/78

Replaceable Parts (Cont.)

REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION
R24	0683-5615	1	R-F: 560 5%
R25	0683-1015	3	R-F: 100 5%
R26	0683-6805	1	R-F: 68 5%
R27,R28	0683-1015		R-F: 100 5%
R29,R30	0683-1035		R-F: 10K 5%
R31	0683-2715		R-F: 270 5%
R32,R33	0683-2015		R-F: 200 5%
R34	0683-3915	1	R-F: 390 5%
R35	0683-2025		R-F: 2K 5%
R36	0757-0442	1	R-F: 10K 1%
R37	0757-0438	1	R-F: 5.11K 1%
R38	0757-0429	1	R-F: 1.82K 1%
R39,R40	0757-0420	2	R-F: 750 1%
R41	0757-0470	1	R-F: 162K 1%
R42	0698-4532	1	R-F: 280K 1%
R43	0683-2025		R-F: 2K 5%
R44	0683-1525		R-F: 1.5K 5%
U1	1820-1207	2	IC: 74LS30
U2	1820-1199	3	IC: 74LS04
U3	1820-1433	4	IC: 74LS164
U4	1820-1197	1	IC: 74LS00
U5	1820-0799	1	IC: 75452
U6	1820-1207		IC: 74LS30
U7	1820-1199		IC: 74LS04
U8,U9	1820-1112	7	IC: 74LS74
U10	1820-1211	1	IC: 74LS86
U11	1820-1199		IC: 74LS04
U12	1820-1202	1	IC: 74LS10
U13	1820-0471	1	IC: 7406
U14	1820-0321	1	IC: Comparator 710
U15	1821-0001	1	IC: CA3046
U16	1820-1217	1	IC: 74LS151
U17	1820-1433		IC: 74LS164
U18	1820-1194	1	IC: 74LS193
U19	1820-1112		IC: 74LS74
U20	1820-0579	1	IC: 74123
U21	1820-0427	1	IC: MC1496
U22	1820-1433		IC: 74LS164
U23	1820-1820	1	IC: PLA−BUM DM 8575
U24	1820-1112		IC: 74LS74
U25	1820-1416	1	IC: 74LS14
U26	1820-1819	1	IC: PLA−BUL DM 8575
U27,U28	1820-1112		IC: 74LS74
U29	1820-1433		IC: 74LS164
U30	1820-1112		IC: 74LS74
A5	**09885-66505**		**Drive Electronics Assembly**
C1	0180-1794	1	C-F: 22UF 35V
C2	0160-0576	11	C-F: .1UF 50V
C3,C4	0180-0229	2	C-F: 33UF 10V
C5	0160-0576		C-F: .1UF 50V
C6 thru C8	0160-3847	6	C-F: .01UF 25V
C9 thru C11	0160-0576		C-F: .1UF 50V
C12	0160-2199	1	C-F: 30PF 300V
C13	0180-0309	1	C-F: 4.7UF 10V
C14	0180-0291	1	C-F: 1UF 35V
C15	0160-3847		C-F: .01UF 25V

Replaceable Parts (Cont.)

REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION
C16	0160-2204	2	C-F: 100PF 300V
C17 thru C19	0160-0576		C-F: .1UF 50V
C21	0160-3847		C-F: .01UF 25V
C22	0160-2035	1	C-F: 750PF 300V
C23	0160-0939	1	C-F: 430PF 300V
C24	0160-3847		C-F: .01UF 25V
C25	0160-4441	1	C-F: .47UF 50V
C26	0160-0576		C-F: .1UF 50V
C27	0140-0197	1	C-F: 180PF 300V
C28	0160-0576		C-F: .1UF 50V
C29	0180-0291		C-F: 1UF 35V
C30	0160-2204		C-F: 100PF 300V
C31	0180-1743	1	C-F: .1UF 35V
C32	0160-0576		C-F: .1UF 50V
C33	0160-3847		C-F: .01UF 25V
CR1,CR2	1901-0028	6	DIO: SI .75A 400V
CR3 thru CR9	1901-0050	7	DIO: SI
CR10 thru CR13	1901-0028		DIO: SI .75A 400V
L1 thru L4	9100-2562	5	L-F: 100UH
L5,L6	9100-1642	2	L-F: 270UH
L7,L8	9100-1631	2	L-F: 56UH
L9	9100-2562		L-F: 100UH
P2,P3	1251-4498	2	7-Pin Connector
P4	1251-4499	1	5-Pin Connector
Q1	1854-0354	3	XSTR: NPN SS2077
Q2	1854-0456	3	XSTR: NPN SI
Q3	1854-0354		XSTR: NPN SS2077
Q4	1854-0456		XSTR: NPN SI
Q5	1854-0354		XSTR: NPN SS2077
Q6	1854-0456		XSTR: NPN SI
Q7 thru Q9	1854-0071	3	XSTR: NPN SPS5103
R1	0683-1215	1	R-F: 120 5%
R2	0683-3025	7	R-F: 3K 5%
R3,R4	1810-0136	2	R-Network 216C
R5	0683-1025	3	R-F: 1K 5%
R6	0698-3265	1	R-F: 118K 1%
R7,R8	0683-1025		R-F: 1K 5%
R9	0683-1235	1	R-F: 12K 5%
R10	0683-3025		R-F: 3K 5%
R11	0698-3453	1	R-F: 196K 1%
R13,R14	0757-0277	2	R-F: 49.9 1%
R15,R16	0683-3335	2	R-F: 33K 5%
R17	2100-3054	1	R-Variable 50K 10%
R18 thru R20	0764-0033	3	R-F: 33 5%
R21,R22	0683-5115	5	R-F: 510 5%
R23,R24	0683-2715	4	R-F: 270 5%
R25	0683-8215	1	R-F: 820 5%
R26	0683-5115		R-F: 510 5%
R27	0683-2715		R-F: 270 5%
R28	0683-1035	5	R-F: 10K 5%
R29	0683-4745	3	R-F: 470K 5%
R30	0683-3025		R-F: 3K 5%
R31	0698-4386	2	R-F: 59 1%
R32,R33	0698-4461	2	R-F: 698 1%
R34	0683-3915	1	R-F: 390 5%
R35	0683-1035		R-F: 10K 5%

Replaceable Parts (Cont.)

REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION
R36	0683-4745		R-F: 470K 5%
R37,R38	0683-3025		R-F: 3K 5%
R39	0683-4745		R-F: 470K 5%
R40	0683-1035		R-F: 10K 5%
R41	0683-5115		R-F: 510 5%
R42	0683-2405	1	R-F: 24 5%
R43,R44	0683-2035	4	R-F: 20K 5%
R45,R46	0757-0288	2	R-F: 9.09K 1%
R47	0698-4454	2	R-F: 523 1%
R48,R49	0683-3025		R-F: 3K 5%
R50	0698-4454		R-F: 523 1%
R51,R52	0683-2035		R-F: 20K 5%
R53	0683-5115		R-F: 510 5%
R54	0757-0409	1	R-F: 274 1%
R55	0757-0422	2	R-F: 909 1%
R56	0757-0398		R-F: 75 1%
R57	0686-3625	1	R-F: 3.6K 5%
R58	0683-2715		R-F: 270 5%
R59	0683-3558	1	R-F: 4.02K 1%
R60 thru R62	0698-3447	3	R-F: 422 1%
R63	0757-0424		R-F: 1100 1%
R64	0683-1035		R-F: 10K 5%
R65	0683-1815	2	R-F: 180 5%
R66	0698-3558		R-F: 4.02K 1%
R67	0683-1815		R-F: 180 5%
R68	0683-6225	1	R-F: 6.2K 5%
R69	0698-0085	1	R-F: 2.61K 1%
R70	0698-4500	1	R-F: 57.6K 1%
R71	0683-3335	1	R-F: 33K 5%
R72	0683-2235		R-F: 22K 5%
R73	0686-1515	2	R-F: 150 5%
R74	0698-5083	1	R-F: 39
R75	0686-1515		R-F: 150 5%
R76	0686-1515	1	R-F: 150 5%
R77 thru R79	0689-2205	3	R-F: 22
U1	1820-1112	4	IC: 74LS74
U2	1820-0269	1	IC: 7403
U3	1820-1425	2	IC: 74LS132
U4	1820-1112		IC: 74LS74
U5	1820-1203	1	IC: 74LS11
U6	1820-0621	1	IC: 7438
U7	1820-1208	1	IC: 74LS32
U8	1820-1211	2	IC: 74LS86
U9	1820-1423	1	IC: 74LS123
U10	1820-1112		IC: 74LS74
U11	1820-1199	1	IC: 74LS04
U12	1820-1048	1	IC: MU8T20
U13	1820-1212	2	IC: 74LS112
U14	1820-1201	1	IC: 74LS08
U15	1820-1212		IC: 74LS112
U16	1820-0194	1	IC: NE592
U17	1820-1307		IC: 74S132
U18	1820-1202	1	IC: 74LS10
U19	1820-0513	1	IC: 7409
U20	1820-1211		IC: 74LS86

Replaceable Parts (Cont.)

REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION
U21,U22	1820-1197	2	IC: 74LS00
U23	1826-0174	1	IC: MC3302
U24	1858-0053	1	IC: XSTR-Q2T2222
U25	1820-1112		IC: 74LS74
U26	1820-0668	1	IC: 7407
U27	1820-1437	1	IC: 74LS221
U28	1858-0052	1	IC: XSTR-Q2T2905
A6	**09885-66506**		**Interconnect Assembly (Master)**
C1	0160-3847	1	C-F: .01UF 25V
CR1	1990-0487	1	LED
CR2 thru CR8	1901-0040	7	DIO: SI .05A 30V
R1	0683-4715	1	R-F: 470 5%
P1	0360-1706	1	Connector - 3m 3426
P2	0362-0390	1	Connector
	0380-0565	4	Standoff Bushing
		1	Drive Assembly Cable (order 09885-66506)
	09885-61602	1	Mother Assembly Cable
J2	1251-4464	1	37 pin Connector
J1	1251-4465	1	50 pin Connector
S1	3100-2117	1	Self Test Switch
S2	3100-3388	1	Drive Number Switch
A7	**09885-66507**		**Indicator Assembly**
	1251-4498	1	7-pin Connector
CR2,CR3	1990-0487	2	LED
CR1	1990-0485	1	LED
A8	**09885-66508**		**Interconnect Assembly (Slave)**
C1	0160-3847	1	C-F: .01UF 25V
C2,C3	0160-0127	2	C-F: 1UF 25V
CR2 thru CR8	1901-0040	7	DIO: SI .05A 30V
P1	0360-1706	1	Connector - 3m 3426
P2	0362-0390	1	Connector
R1	0683-4715	1	R-F: 470 5%
S2	3100-3388	1	Drive Number Switch
	0380-0565	4	Standoff Bushing
		1	Drive Assembly Cable (order 09885-66508)
	1251-4464	2	37-pin Connector
	7120-5345	1	Decal
	09885-64401		**Chassis Assembly**
	09885-01201	1	Center Bracket
	09885-01204	1	Drive Mounting Bracket
	09885-01205	1	Rear Bracket
	09885-01206	1	Heatsink Bracket
	09885-64402	1	Top Cover
	09885-64403	1	Bottom Cover
	2510-0205	5	Machine Screw 8-32
	5020-8836	4	Corner Strut
	5040-7201	2	Foot
	5040-7202	2	Foot
	0570-1171		Screw ⎫
	0510-0043		C-ring ⎬ Mntg hardware for covers.

Replaceable Parts (Cont.)

REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION
	09885-67901		**Rear Panel Assembly (Master)**
	09885-67903		Rear Panel Assembly (Slave)
	0390-0006	4	Nylon Spacer
	09885-00201	1	Rear Panel (Master)
	09885-00202	1	Rear Panel (Slave)
	3101-2042	2	Voltage Selector Switch
Z1	9100-3875	1	Line Filter
	09885-61605	1	Power Cable (internal)
	3101-2080	1	Power Switch
	5040-8076	1	Rocker for power switch
	09885-64405	2	Hole Cover
	09885-64601	1	Fan Screen
	1251-2262	1	PC Assembly Connector (transformer)
	1251-4342	2	Pins for motor connector
	1251-4466	1	Motor connector housing
	2110-0543	1	Fuse Holder
	2110-0545	1	Fuse Holder Cap
	2190-0575	1	Washer
	3050-0835	1	Washer
	3160-0288	1	Fan
	5020-8804	1	Rear Casting
	9100-3498	1	Power Transformer
	09885-67902		**Front Panel Assembly**
	0460-0879	1	Foam Rubber Stopper
	0510-0578	1	Restraining Patch
	09885-01202	1	Left Front Bracket
	09885-01203	1	Right Front Bracket
	09885-60201	1	Front Panel
	5040-8059	1	Eject Button
	7120-5851	1	Label, Front Panel
			Miscellaneous
F1	2110-0303	1	Fuse, 2A
	5040-8060	1	Disk Door
	7120-5129	1	Information Label
	7120-5254	1	Serial Plate
	7120-5350	1	Warning Label
	09885-00601	1	Voltage Shield
	09885-31002	2	Side Cover
	09885-61603	1	Indicator Assembly Cable (to A7)
	09885-61604	1	DC Power Cable
	09885-61607	1	Slave Cable
Option 001	**09885-30001**		**50Hz Option Assemblies**
	1535-3649	1	50Hz Drive Belt
	1535-3650	1	50Hz Pulley
	7120-5387	1	Option 001 Label
Option 002	**09885-30002**		**Rack Mount Option Assemblies (98024F)**
	09885-21211	2	Rack Mount Bracket
	09885-24101	2	Rack Mount Side Cover
	7120-5357	1	Option 002 Label
	2190-0010	4	Screw
	2510-0109	4	Screw

Replaceable Parts (Cont.)

REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION
	09885-80000		**Miscellaneous Materials Kit**
	09885-87900	1	Note Book Assembly
	09885-90000	1	9825A/9885 Operating Manual
	09885-90020	1	Disk Care Note
	09885-90035	1	Disk System Cartridge
	09885-90045	1	Initialized Disk
	7120-5160	1	Drive Number Labels (0-3)
	7120-5161	1	Select Code Labels (8-15)
	7120-5255	1	Disk Labels
	7120-5330	1	Customer Information Label
	7120-5388	1	Write Protect Label
	9164-0074	1	Blank Disk
	9230-0420	1	Disk Envelope
	9282-0576	1	Vinyl Bag
	9282-0580	1	Notebook
	09885-90010	1	Reference Guide
	2110-0381	2	Fuse - 3 amp SB
	2110-0544	1	Fuse Holder Cap
	8120-1378	1	AC Power Cable
	98032-61601		**Option 085 Interface Cable**
	1251-2058	1	Connector Lock Assembly
	1251-3399	50	Connector Contact
	1251-4147	1	PCB Edge Connector
	1251-4475	1	Hood R & P Connector
	1251-4480	1	Connector-50 Pin
A1	98015-66501		**Disk Service Fixture**
C1,C2	0160-3847	3	C-F: .01UF
C3	0180-0116	1	C-F: 6.8UF
C4	0180-1743	1	C-F: .1F
C5	0160-3847	1	C-F: .01UF
CR1	1990-0486	1	LED, Red
CR2	1990-0485	1	ED, Green
R1	0683-2215	2	R-F: 220
R2	0683-1025	2	R-F: 1K
R3	0683-1825	2	R-F: 1.8K
R4	0683-1025		R-F: 1K
R5	0683-1825		R-F: 1.8K
R6 thru R10	0683-4725	6	R-F: 4.7K
R11	0683-2215		R-F: 220
R12	0683-4725		RF: 4.7K
R13,R14	0683-7535	2	R-F: 75K
S1	3101-0936	1	Switch SPDT
S2 thru S4	3101-1258	3	Switch SPDT
S5	3101-0063	1	Switch Pushbutton
U1	1820-1443	1	IC: 74LS293
U2	1820-0174	1	IC:7404
U3	1820-1440	1	IC: 74LS279
U4	1820-1437	1	C: 74LS221
Y1	0410-0465	1	XTAL: 4 MHz
	0380-0565	2	Standoff
	1251-1029	1	Connector Lock
		1	Connector AMP P/N 205713-1

Replaceable Parts (Cont.)

REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION	MFR. PART NO.
1		3	Flat Washer, #6	10013
2		1	Flat Washer, #8	10014
3		1	Nut, 8-32	10025
4	1535-3882	1	Drive Motor Capacitor (110V)	10095
		1	Drive Motor Capacitor (220V)	15004
5		1	Connector Block	10140
6		1	Rubber Boot	10148
7		1	3 Pin Connector Housing	10150
8		1	Screw 4-40 × .250"	10172
9		2	Screw 4-40 × .500"	10176
10		2	Screw 6-32 × .250"	10187
11		2	Cable Clamp 1/8"	10262
12		1	Cable Clamp 3/8"	10264
13		2	Cable Clamp 3/16"	10375
14	1410-0662	1	Spindle Bearing	10800
15	1410-0661	1	Flanged Spindle Bearing	10801
16		2	Clip	11305
17		1	Screw 2-56 × .250"	11903
18		1	Screw 6-32 × .125"	11904
19		2	Screw, B.V.	11905
20		2	Screw, 4-40 × .250"	12011
21		2	Screw, 4-40 × .375"	12012
22		12	Screw, 6-32 × .312"	12013
23		13	Screw, 8-32 × .312"	12015
24		3	Screw, 8-32 × .375"	12016
25		2	Screw, 8-32 × .500"	12020
26		1	Screw, 4-40 × .625"	12026
27		3	Screw, 6-32 × .500"	12027
28		4	Screw, 8-32 × .750"	12028
29		2	Lock Washer, #8	12500
30		2	Spring Washer	12509
31	1553-3652	1	Door Open Switch	17200
32	1535-3892	1	Spindle Pulley Assembly	50016
33	1535-3890	1	Long Spindle Spacer	50018
34	1535-3891	1	Short Spindle Spacer	50019
35	50031-SHU	1	Hub Clamp Spring	50031
36		1	Nut	50087
37		1	Pre-Load Spring	50088
38		1	Bracket	50098
39		1	Stepper Motor Plate	50112
40	0955-0088	1	Track 0 Detector Assembly	50121
41	3140-0581	1	110V Motor	50123
42	1150-1316	1	Phototransistor Assembly – Index	50128
43	3140-0582	1	Stepper Motor Assembly	50130
44	1535-3889	1	Spindle Spring	50166
45	1535-3884	1	Cartridge Guide Pivot	50167
46	1535-3885	1	Bias Spring	50168
47		1	Lead Screw Limit Stop	50245
48	50254-SHU	1	Hub Clamp Assembly	50254
49	1150-1309	1	Write Protect Detector Assembly	50313
50	1535-3649	1	50 Hz Belt	50355
	1535-3651	1	60 Hz Belt	50356
51	1535-3650	1	50 Hz Pulley	50357
	50358-SHU	1	60 Hz Pulley	50358
52		1	Plate Spring	50362

Replaceable Parts (Cont.)

REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION	MFR.	MFR. PART NO.
53		1	Dust Cover		50440
54		1	Disk Guide Spring		50522
55		1	Track 0 Flag		50529
56	1535-3648	1	Load Button		50542
57		1	Disk Guide		50544
58	1535-3898	1	Hub Clamp Plate		50546
59		1	Bottom Stripper		50547
60		1	Top Stripper		50548
61		1	Disk Guide Assembly		50550
62	1535-3900	1	Ejector Clamp Spring		50555
63	50556-SHU	1	Spring Hook		50556
64	1150-1313	1	Index LED Assembly		50557
65	1150-1311	1	Head Load Actuator Assembly		50558
66	1150-1369	1	Spindle Hub Assembly		50561
67	1150-1315	1	Carriage Assembly		50562
68		1	Grommet		50578
69		1	Latch Plate		50579
70	50583-SHU	1	Door Open Spring		50583
71		1	Mounting Clamp		50584
72		4	Spacer		50602
73	50609-SHU	1	Ejector Assembly		50609
74		2	Deflector		50559
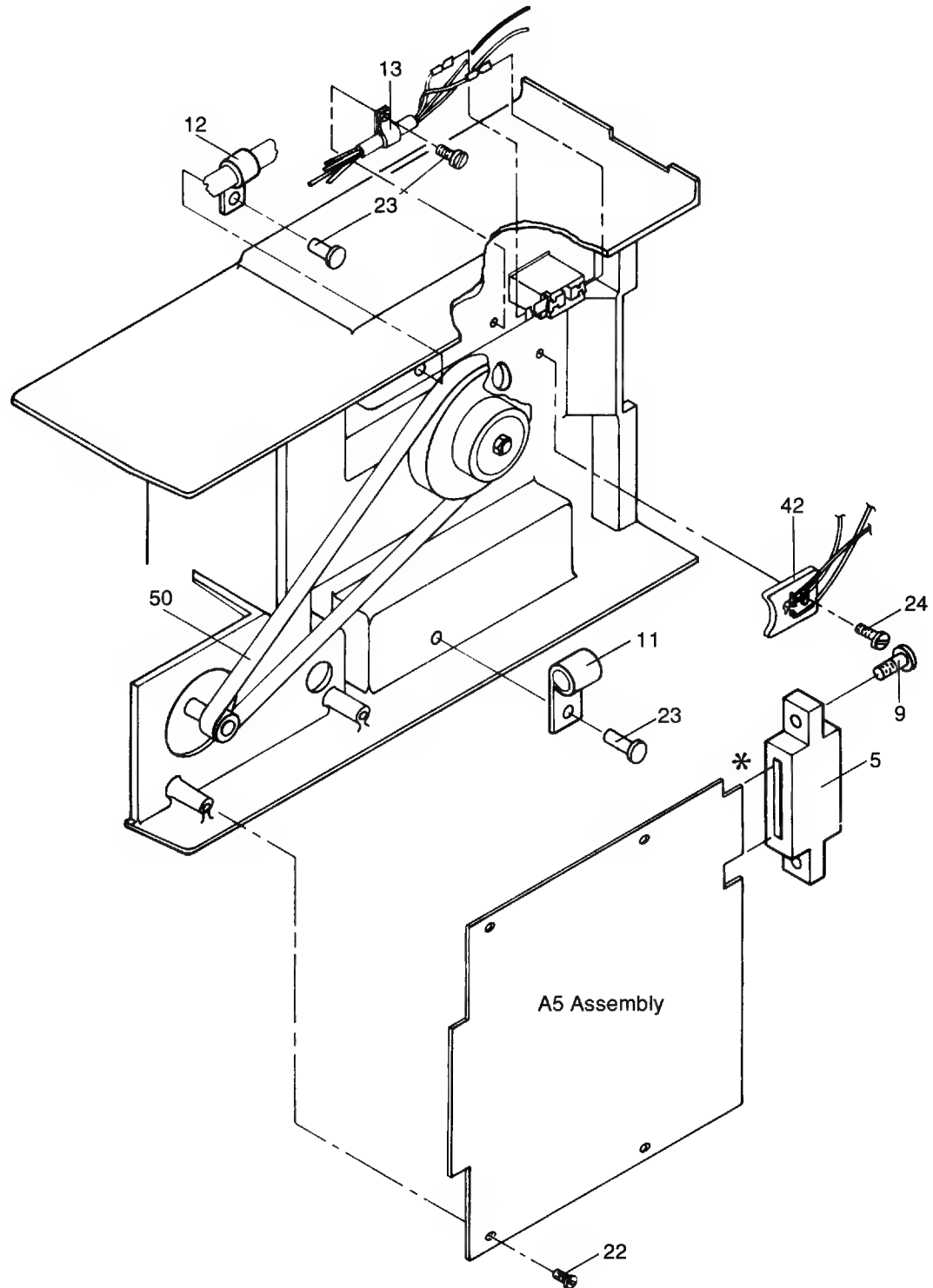
Bottom Drive Chassis

A5 Assembly

* To order replacement connector pins, specify 1251-3882.
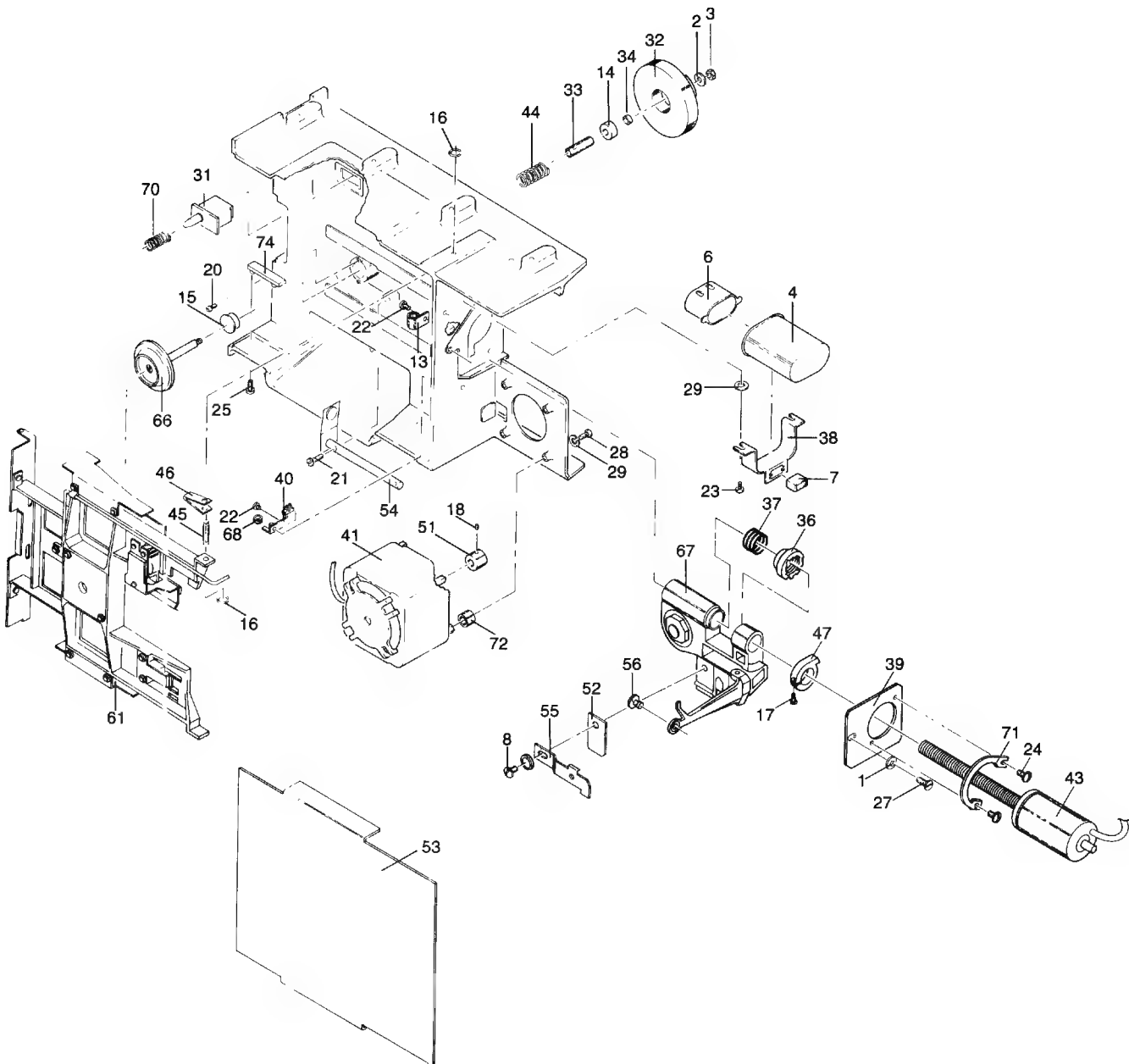
Top Drive Chassis
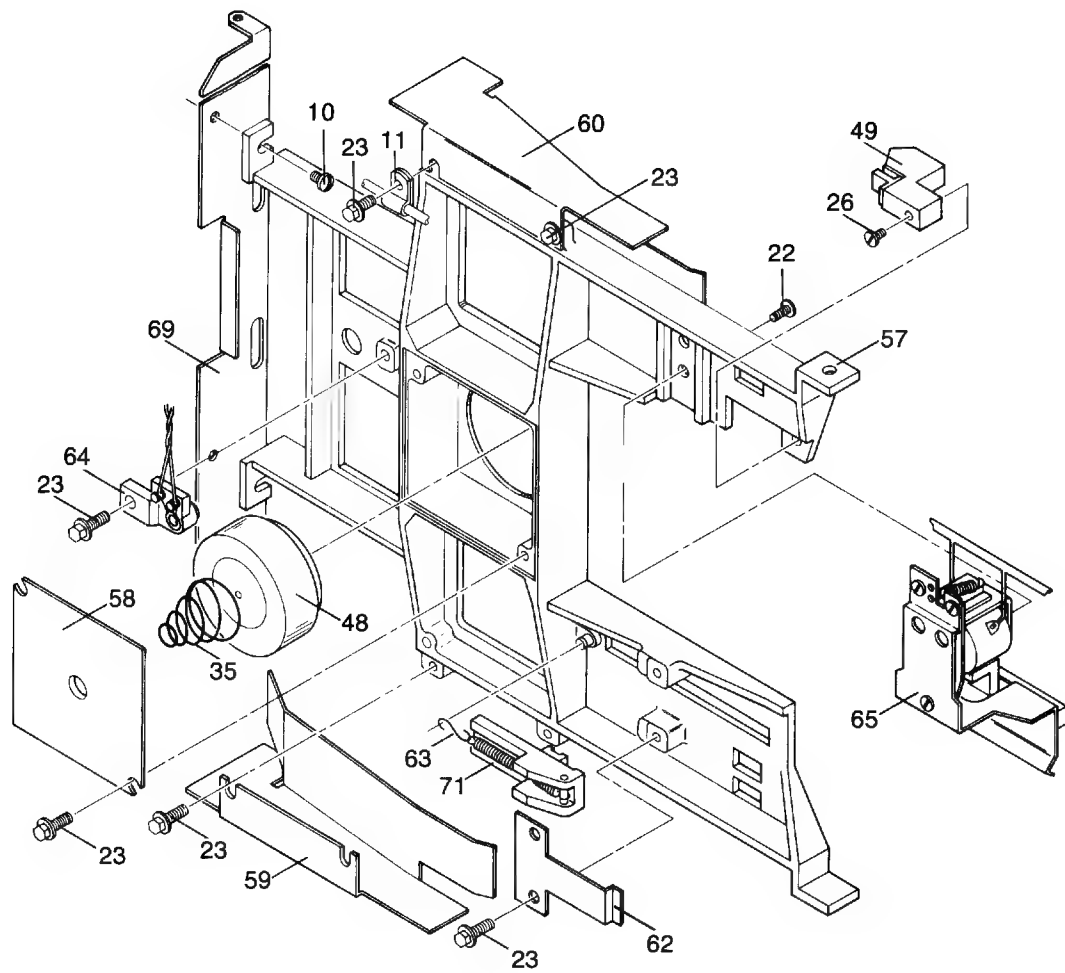
Disk Guide

9885M/S FLEXIBLE DISK

9885M Serial Numbers 1620A00816 And Below
9885S Serial Numbers 1629A00487 And Below

9885M/S Disks with serial numbers listed above may exhibit intermittent prob-
lems due to poor head pads. These pads are white in color. Effective with
the 816 and 487 serial numbers the head pads are red in color. The new head
pads are red in color. The new head pads carry the same part number,
1535-3648. Replace the head pads in your service kits. Do not make any
special service calls, but replace the old head pads during a routine service
call.

To replace the pad use needle nose pliers; simply squeeze the top halves
together and pop out. When inserting a new one do not use pliers; push the
pad in place with your thumb. Properly inserted, the pad should not rotate
without a lot of effort. A pad which rotates easily, almost freely, will
cause Read/Write errors.

After installation of a new head pad it is a good idea to run the head
amplitude check.

WC/bc/WA

5/77-37

Printed in U.S.A.

HEWLETT hp PACKARD

HP 9885M Disk Drive
System Tape Cartridge Update

The System Tape Cartridge (09885-90035) for the 9825A has been upgraded from Rev. B to Rev. C. Reasons for the change are:

1) If a string variable is used to give the destination file name in a COPY command, the destination file is filled with garbage.

2) If a too-short string variable is used in a READ statement, the calculator gets lost.

System cartridges should be replaced at customer's request. C.E.'s should order new cartridges to upgrade their service kit. Order P/N 09885-90035, Rev. C, 6/16/77 and charge to warranty.

9885M Disk Drive
I/O Cable Ground

There has been a production change order written to modify the 9885M Flexible Disk Drive. This P.C.O. will change the grounding point of the I/O cable shield from the motherboard to the interconnect assembly (A-6). Implementation of this change will improve RFI emissions and susceptibility. It will also make a significant improvement in the susceptibility to static discharge.

All 9885M units shipped from the factory on or about 1 June will contain the new boards. All of the old -66506 P.C. Boards (Rev. B) will be purged from stock at CPC and PCE. Any of these boards that are stocked in the fields (kits, etc.) should be scrapped — they are incompatible with the new motherboard (-66500 Rev. C). The old motherboard (-66500 Rev. B) is compatible with either revision level of the -66506 board, with a minor change, and may be retained in service kits and FSI inventory. Refer to the attached table to maintain compatibility when making board level repairs in the field.

This change has proved successful in a number of siuations where static and/or RFI is a problem. If you suspect that these elements may be present, implement this modification. Field installation may be completed by: 1) installing a new 09885-66506 (Rev. C) P.C. Board; 2) removing capacitor C-1 from the motherboard (see page 6-3 of the Service Manual, P/N 09885-90031, for component location). Charge warranty for parts only.

Note that this modification applies only to the 9885M. The 9885S is not affected.

(Cont.)

New Combination		Compatible	Description
09885-66500	09885-66506		
Rev. B (old)	Rev. B (old)	Yes	Original configuration - may be susceptible to RFI and static (shield is grounded) at -66500 Bd)
Rev. C (new)	Rev. B (old)	No	Never install a new -66500 with an old -66506 (shield is ungrounded at the disk)
Rev. B (old)	Rev. C (new)	Yes	Capacitor C-1 should be removed from -66500. This will be the combination when the change is field installation on units shipped before 1 May, '78. (shield is grounded at the -66506 Bd)
Rev. C (new)	Rev. C (new)	Yes	Production level (shield is grounded at the -66506 Bd)

HP 9885M Flexible Disc Drive
Record Header Errors

All 9885M Discs with serial number 1628A03070 and below may exhibit inter-mittent record header errors. The decoder state machine on the A-4 data elec-tronics board can become confused by some unique data patterns falsely detect-ing them as header patterns. This will cause the error signal in the phased locked loop to become so large that the loop cannot respond to the correct header pattern (preamble) when it is read. The result is generally a record header error (9831 Error = 83) (9825 Error = d5), etc.

Although the possibility of the problem occuring during normal operation is unlikely, we would like to upgrade all the A-4 boards in the exchange program. This will ensure that an unmodified board does not get installed in a new unit and those units that exhibit this failure will get modified boards. The field Cus-tomer Engineer should modify all his kit boards; the Green Stripe Program will change all the unmodified boards that are returned.

The fix involves changing R-13 on the A-4 board from a 10 K OHM 5% to a 8.2 K OHM 5% resistor. Refer to page 6-11 of the Flexible Disc Service Manual (p/n 09885-90031) for component location. The part number for the 8.2 K OHM resistor is 0683-8225.

FCD warranty will cover the part costs plus one-half hour labor to modify each A-4 kit board (p/n 09885-69504). This warranty is valid only on those repair orders dated no later than October 31, 1978.

HP 98015A
All Units in Field

The 98015A Service Kit has been shipped without some of the supporting elements for the 9831A/9885M System. A new kit contents list was generated in March '77 which reflected these new add-on's. This created a discrepancy between the actual kit contents and the new contents list. To correct the inventory problem and up-grade your existing kits for 9831A/9885M support, order these five items (they can be charged to warranty through October 31, 1977). All future shipments after August 1, 1977 will be complete.

Part No.	Description
09831-90031	9831A System Test Manual
09831-90035	System Test Cartridge (for 9831A)
09885-90060	Initialized Disk (for 9831A)
98218-69901	Mass Memory ROM, RSTO 6790 (for 9831A)
98015-90000	Service Kit Contents list

Product Support Package
for the
9885M/S Flexible Disk Drive

(P/N 09885-67101)

This 9885 Product Support Package has the manuals, diagnostics, small parts and special tools needed to service 9885M/S Disk Drives which are installed in an HP 9800-series Desktop Computer system.

Support Package Contents

Description	Qty.	Part Number
9885M/S Service Manual	1	09885-90031
9831A System Test Manual	1	09831-90031
System Test Cartridge (for 9825A)	1	09885-90035
System Test Cartrdige (for 9831A)	1	09831-90035
Initialized Disk (for 9825A)	2	09885-90045
Initialized Disk (for 9831A)	2	09885-90060
Fuse 3A, Slow Blow	4	2110-0381
Fuse 2A, Slow Blow	4	2110-0303
Load Button	4	1535-3648
Cartridge Guide Adjustment Tool	1	1150-1310
Load Bail Gauge	1	1150-1312
Alignment Disk	1	1150-1314
Disk Service Fixture (DSF)	1	98015-66501
Alignment Clamp	1	8710-1120
Plastic Box	1	1540-0015
Carrying Case	1	98015-64501

2 pages

In addition to the product support package, it's recommended that the following replacement parts and exchange assemblies be kept on hand to facilitate servicing. Order these items thru either CSC or PCE.

Recommended Field Service Inventory

Description	Qty.	Part Number
Motherboard	1	09885-66500
Power Supply, RSTD-66501	1	09885-69501
Bit/Byte, RSTD-66502	1	09885-69502
I/O Processor, RSTD-66503	1	09885-69503
Data Electronics, RSTD-66504	1	09885-69504
Drive Electronics, RSTD-66505	1	09885-69505
Master-Slave Interface Cable	1	09885-61607
Track 0 Detector	1	0955-0088
Head Load Actuator	1	1150-1311
Carriage Assembly	1	1150-1315
Write Protect Detector	1	1150-1309
LED Assembly	1	1150-1313
Photo Transistor Assembly	1	1150-1316
Interface Cable Assembly, Option X85	1	98032-67913
Mass Memory ROM, RSTD-67901 (for 9825A)	1	98217-69901
Mass Memory ROM, RSTD-67901 (for 9831A)	1	98218-69901

The 9885 Product Support Package and the recommended Field Service Inventory (FSI) together replace the 98015A Service Kit.

Product Support Package
for the
9885M/S Flexible Disk Drive

(P/N 09885-67102)

This 9885 Product Support Package has the manuals, diagnostics, small parts and special tools needed to service 9885M/S Disk Drives which are installed in an HP 21MX-series computer system.

Support Package Contents

Description	Qty.	Part Number
Fuse 3A, Slow Blow	4	2110-0381
Fuse 2A, Slow Blow	4	2110-0303
Load Button	4	1535-3648
Cartridge Guide Adjustment Tool	1	1150-1310
Load Bail Gauge	1	1150-1312
Alignment Disk	1	1150-1314
Disk Service Fixture (DSF)	1	98015-66501
Alignment Clamp	1	8710-1120
Plastic Box	1	1540-0015
Carrying Case	1	98015-64501

2 pages

In addition to the product support package, it's recommended that the following replacement parts and exchange assemblies be kept on hand to facilitate servicing. Order these items thru either CSC or PCE.

Recommended Field Service Inventory

Description	Qty.	Part Number
Motherboard	1	09885-66500
Power Supply, RSTD-66501	1	09885-69501
Bit/Byte, RSTD-66502	1	09885-69502
I/O Processor, RSTD-66503	1	09885-69503
Data Electronics, RSTD-66504	1	09885-69504
Drive Electronics, RSTD-66505	1	09885-69505
Master-Slave Interface Cable	1	09885-61607
Track 0 Detector	1	0955-0088
Head Load Actuator	1	1150-1311
Carriage Assembly	1	1150-1315
Write Protect Detector	1	1150-1309
LED Assembly	1	1150-1313
Photo Transistor Assembly	1	1150-1316
Interface Cable Assembly, Option X85	1	98032-67913
Mass Memory ROM, RSTD-67901 (for 9825A)	1	98217-69901
Mass Memory ROM, RSTD-67901 (for 9831A)	1	98218-69901

The 9885 Product Support Package and the recommended Field Service Inventory (FSI) together replace the 98015B Service Kit.

98015A Service Kit
for the
9885 Flexible Disk Drive

The 98015A Service Kit contains the printed circuit assemblies and mechanical parts necessary to service the 9885 Flexible Disk Drive. This kit applies to the 9885 M/S when it is controlled by a 9800-series desktop computer (e.g., the 9825A or 9831A). The service kit contents are listed on the next page. This list replaces the previous list dated 7/26/76.

Hewlett-Packard Fort Collins Division
P.O. Box 1550, Fort Collins, Colorado 80522, Tel. (303)221-5000

HEWLETT **hp** *PACKARD*

98015A Service Kit

Description	Qty.	Part Number
Power Supply, RSTD-66501	1	09885-69501
Bit/Byte, RSTD-66502	1	09885-69502
I/O Processor, RSTD-66503	1	09885-69503
Data Electronics, RSTD-66504	1	09885-69504
Drive Electronics, RSTD-66505	1	09885-69505
Mass Memory ROM, RSTD-67901 (for 9825A)	1	98217-69901
Mass Memory ROM, RSTD-67901 (for 9831A)	1	98218-69901
Motherboard	1	09885-66500
Track 0 Detector	1	0955-0088
Head Load Actuator	1	1150-1311
Carriage Assembly	1	1150-1315
Write Protect Detector	1	1150-1309
LED Assembly	1	1150-1313
Photo Transistor Assembly	1	1150-1316
Load Button	4	1535-3648
Cartridge Guide Adjustment Tool	1	1150-1310
Load Bail Gauge	1	1150-1312
Alignment Disk	1	1150-1314
Disk Service Fixture (DSF)	1	98015-66501
Alignment Clamp	1	8710-1120
Rear Housing and Cable Assembly, Option 085	1	98032-67913
Carrying Case	1	98015-64501
Plastic Box	1	1540-0015
System Tape Cartridge (for 9825A)	1	09885-90035
System Tape Cartridge (for 9831A)	1	09831-90035
Initialized Disk (for 9825A)	2	09885-90045
Initialized Disk (for 9831A)	2	09885-90060
9885M/S Service Manual	1	09885-90030
9831A System Test Manual	1	09831-90031
Master-Slave Interface Cable	1	09885-61607
Fuse 3A, Slow Blow	4	2110-0381
Fuse 2A, Slow Blow	4	2110-0303

98015B Service Kit
for the
9885 Flexible Disk Drive

The 98015B Service Kit contains the printed circuit assemblies and mechanical parts necessary to service the 9885 Flexible Disk Drive. This kit applies to the 9885 M/S when it is controlled by a 21MX-series computer. The service kit contents are listed on the next page.

HEWLETT **hp** *PACKARD*

98015B Service Kit

Description	Qty.	Part Number
Power Supply, RSTD-66501	1	09885-69501
Bit/Byte, RSTD-66502	1	09885-69502
I/O Processor. RSTD-66503	1	09885-69503
Data Electronics, RSTD-66504	1	09885-69504
Drive Electronics, RSTD-66505	1	09885-69505
Motherboard	1	09885-66500
Track 0 Detector	1	0955-0088
Head Load Actuator	1	1150-1311
Carriage Assembly	1	1150-1315
Write Protect Detector	1	1150-1309
LED Assembly	1	1150-1313
Photo Transistor Assembly	1	1150-1316
Load Button	4	1535-3648
Cartridge Guide Adjustment Tool	1	1150-1310
Load Bail Gauge	1	1150-1312
Alignment Disk	1	1150-1314
Disk Service Fixture (DSF)	1	98015-66501
Alignment Clamp	1	8710-1120
Carrying Case	1	98015-64501
Plastic Box	1	1540-0015
9885M/S Service Manual	1	09885-90030
Master-Slave Interface Cable	1	09885-61617
Fuse 3A, Slow Blow	4	2110-0381
Fuse 2A, Slow Blow	4	2110-0303